



KODEN

OPERATION MANUAL

MARINE RADAR

MDC-2240/2260/2210/2220

MDC-2540/2560/2510/2520

This product is specifically designed to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.

Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the produced Marine Radar System manufactured by

Koden Electronics Co., Ltd.

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Intended for Worldwide use as a Marine Radar for use aboard non-SOLAS vessels and identified by the type number **MDC-2240 / MDC-2260 / MDC-2210 / MDC-2220** to which this declaration refers has been tested to the essential radio test suites required by the notified body and is in conformity with the standards

EN 60945 : 2002 (Clauses 9,10 & 12)

EN 62252 : 2004 (Clauses 4.8, 4.33, 5.8, 5.33 and Annex D)

ITU-R Recommendation RM.1177

and complies with the essential requirements of Directive 1999/5/EC

Conformity procedure under Annex IV of 1999/5/EC (Technical Construction file) has been undertaken by

QinetiQ Ltd. Cody Technology Park Ively Road, Farnborough GU14 0LX. United Kingdom

The Technical Construction File is held by Mr Heinz Hoghoff at

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Kenichi Chiwaki, QA Manager.

Koden Electronics Co., Ltd.

12 Jul. 2007



Notified Body : QinetiQ

Statement Number: QQ-RTTE-15/07-01

: QQ-RTTE-16/07-01

: QQ-RTTE-17/07-01

: OO-RTTE-18/07-01

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Intended for Worldwide use as Marine Radar for use aboard non-SOLAS vessels and identified by the type numbers **MDC-2241** to which this declaration refers have been assessed to Conformity Procedure Annex IV of the Directive and by application of the following standard(s):

Harmonised Standards(s):

EN 302 248 V1.1.2 (2008-06)

Non-Harmonised Standards(s):

**EN 60945 (2002) including IEC 60945 Corrigendum 1 (2008), (Clauses 9, 10 & 12),
EN 62252:2004 (clauses 4.8,(5.8) 4.33, (5.33) and Annex D),
ITU-R Recommendation RM.1177**

and complies with the essential requirements of Directive 1999/5/EC

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Koji Kawamoto, QA Manager.

Koden Electronics Co., Ltd

18 Oct, 2011.



Document No. 71-2731U-X006

Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the produced Marine Radar System manufactured by

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Intended for Worldwide use as Marine Radar for use aboard non-SOLAS vessels and identified by the type numbers **MDC-2541/MDC-2541BB** to which this declaration refers have been assessed to Conformity Procedure Annex IV of the Directive and by application of the following standard(s):

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Non-Harmonised Standards(s):

**EN 60945 (2002) including IEC 60945 Corrigendum 1 (2008), (Clauses 9, 10 & 12),
EN 62252:2004 (clauses 4.8,(5.8) 4.33, (5.33) and Annex D),
ITU-R Recommendation RM.1177**

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Chapter 1 Preface




1.1 About this operation manual

First of all, Kodan Electronics CO., Ltd. would like to express our sincere gratitude for your purchase of this MDC-2200/2500 series Radar.


This operation manual (hereinafter referred to as “this document”) describes operations and maintenance of the radar systems MDC-2200/2500 series (hereinafter referred to as “this device”).

Please keep this document in the location near the device to refer at any time when required.

The following symbol is displayed on the important part of safety usage of this device among this description. The way as a symbol and the semantics are as follows.

Symbol	Meaning
Warning	Mark for warning This symbol denotes that there is a risk of death or serious injury when not dealing with it correctly.
 Caution	Mark for caution This symbol denotes that there is a risk of slight injury or damage of device when not dealing with it correctly.
	Mark for danger high voltage This symbol denotes that there is a risk of death or serious injury caused by electric shock when not dealing with it correctly.
	Mark for prohibition This symbol denotes prohibition of the specified conduct. Description of the prohibition is displayed near the mark.

The following symbol is attached to important information among the descriptions in this document.

Symbol	Meaning
IMPORTANT	Mark for important matters This mark denotes that there is a possibility that data loss may interfere the operation or that the expected result may not be obtained when not dealing with it correctly.
	Mark for reference This mark shows the part to be referred related to this description.

1.2 For safe usage



Caution

Caution about the rotating aerial

The radar antenna may start to rotate without notice. Please stand clear from the antenna for your safety.



Caution

Caution about electromagnetic disturbance

The operating antenna & scanner unit radiates high-energy electromagnetic wave. It may cause harmful effect for human body due to its continuous irradiation. As International regulation says, electromagnetic waves less than 100 watt/m² does not have a harmful effect on human bodies, but some kind of medical devices such as heart pacemakers are sensitive even under the low energy electromagnetic wave. Any personnel with such a device should keep away from the electromagnetic wave generating position at all times.

Specified power density and distance from the device (in accordance with the provision as specified in IEC 60945)

Model name	Output power/ Antenna length	100W/m ²	10W/m ²
MDC-2240	4kW / 3 feet Antenna	0.9m	2.85m
/MDC-2540	4kW / 4 feet Antenna	1.01m	3.2m
MDC-2260	6kW / 4 feet Antenna	1.09m	3.46m
/MDC-2560	6kW / 6 feet Antenna	1.3m	4.10m
MDC-2210	12kW / 4 feet Antenna	1.55m	4.89m
/MDC-2510	12kW / 6 feet Antenna	1.84m	5.81m
MDC-2220	25kW / 6 feet Antenna	2.82m	8.91m
/MDC-2520	25kW / 9 feet Antenna	3.35m	10.6m



Caution about internal high voltage.

Confirm that the ship's power source and power supply of this device is turned off when doing an internal inspection of this device.

The maintenance and inspection of these devices should be performed by qualified technical personnel.

Post the notice of "During inspection" label near the power switch of this device during service and inspecting.

High voltage is used inside this device. This high voltage may remain in the circuit even after the power switch had turned off.


**Warning****Caution against the dust**

Please wear a safety mask in the case of cleaning the interior of the device. Dust may temporarily cause a disease of the respiratory system. Be careful not to inhale dust.

**Caution****Caution against static electricity**

Please handle the printed circuit board only after taking measures against static electricity. Static electricity occurs from the carpet on the floor of the cabin, etc. and clothes made of synthetic fiber and may damage the electronic parts on the printed circuit board.

1.3 Disposal of used cell and this device

 Warning	<p>A high-energy density lithium ion cell is built in this device.</p> <p>Improper disposal of a lithium ion cell is discouraged as the cell has a possibility of short-circuiting. If it gets wet, the generation of heat, explosion or ignition may occur resulting in an injury or a fire.</p>
--	---

Treatment of the used lithium ion cell

- To dispose of built-in lithium ion cell in this device, insulate each terminal with scotch tape, etc. and wrap in plastic bag, etc.
- The disposal and collection rules may be different depending on each country. Obey the directions of each country.

Disposal of this device

- This device shall be disposed according to the regulations or rules.

1.4 Principal features of this device

The MDC-2540/2560/2510/2520 type Radar system is a compact and high performance shipboard radar system consisting of the antenna & scanner unit with a transmit power of 4kW/6kW/12kW/25kW, a display unit with a 15 inch color LCD display and operating panel unit. The MDC-2240/2260/2210/2220 type Radar system is the system which consists of the antenna & scanner unit with the transmit power 4kW/6kW/12kW/25kW and display unit with 12.1 inch color LCD display.

For this device, its multi functions and high performance is accomplished with microcomputer technology as well as an image processing in the newly developed radar-dedicated LSI.

- A slim display unit using liquid crystal technology.
- Stable indication and reliable acquisition of small target.
- Clear distinction between moving target and land by true trail display.
- Provision of multi targets ATA information and the chart display (mandatory or optional).
- Various models for selection of an optimum device for your needs.
- Simple and easy operation by user-friendly rotating knobs.
- Capable of adjusting gain, anti- sea clutter, anti- rain clutter, bearing cursor, and range marker, etc. using rotating knobs.
- The waterproof (IPX5) display unit and operating panel have a great flexibility in installation.

1.5 In case no Heading and Speed signals are input from navigation equipment

When no Heading and Speed signals are input from navigation equipment (in case not connected), this radar gives alarms and warning messages on the screen, if the radar is started up by factory default settings.

These alarms are disengaged by pressing "OFF" key temporarily, however, the alarms are activated again next time the radar is started up.

Disengage the alarm detection function on start up by the following setting. Once set, the alarm is not detected next time the radar is started up.

MENU => DATADISP => PROTECT CANCEL => **ENT**

MENU => NAV => STAB => GND => SEA => **ENT**

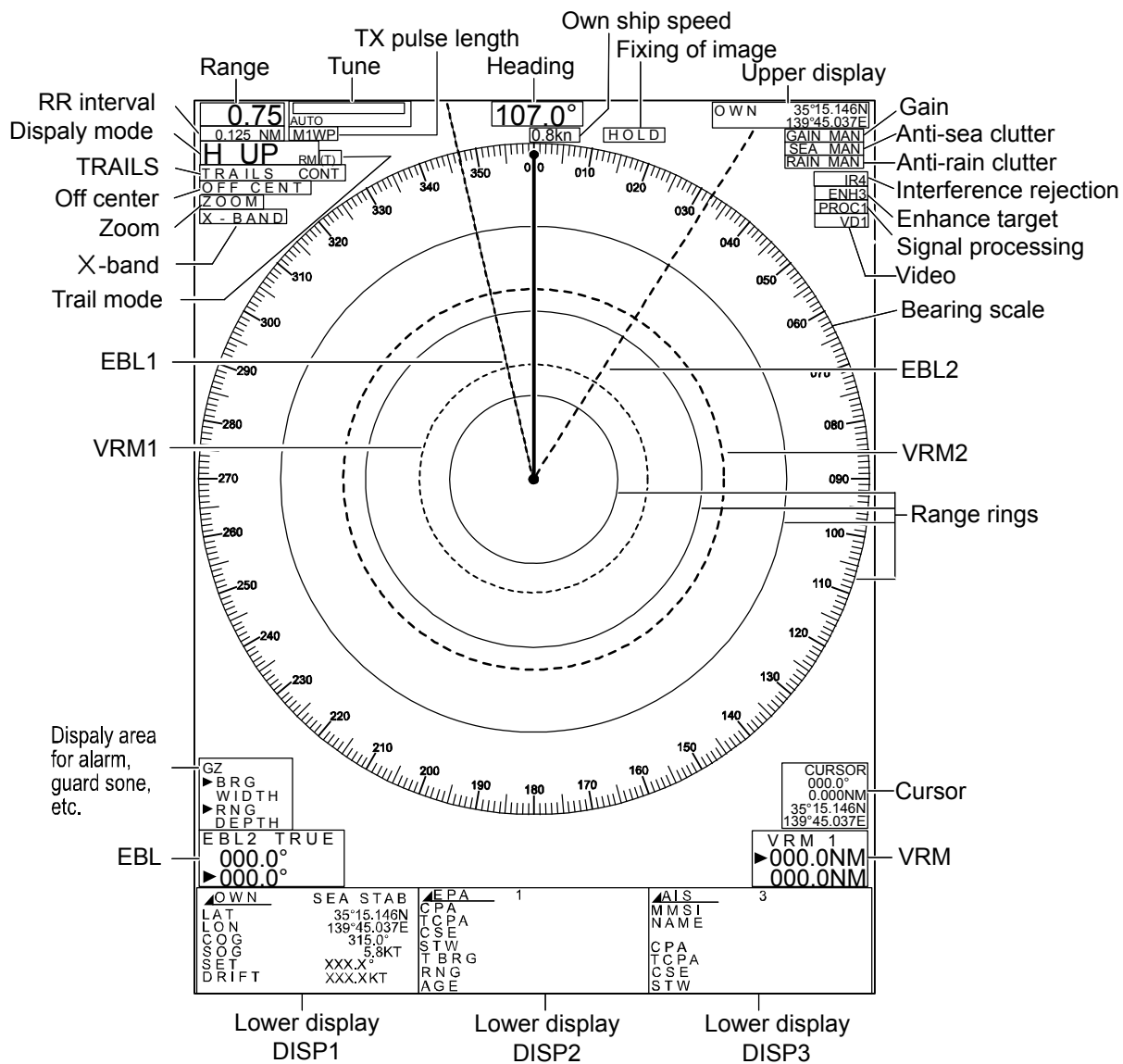
NAV => VECTOR TRUE/REL => TRUE => REL => **ENT**

I/O => HDG => HDG => ON => OFF => **ENT**

I/O => SPD => SPD => ON => OFF => **ENT**

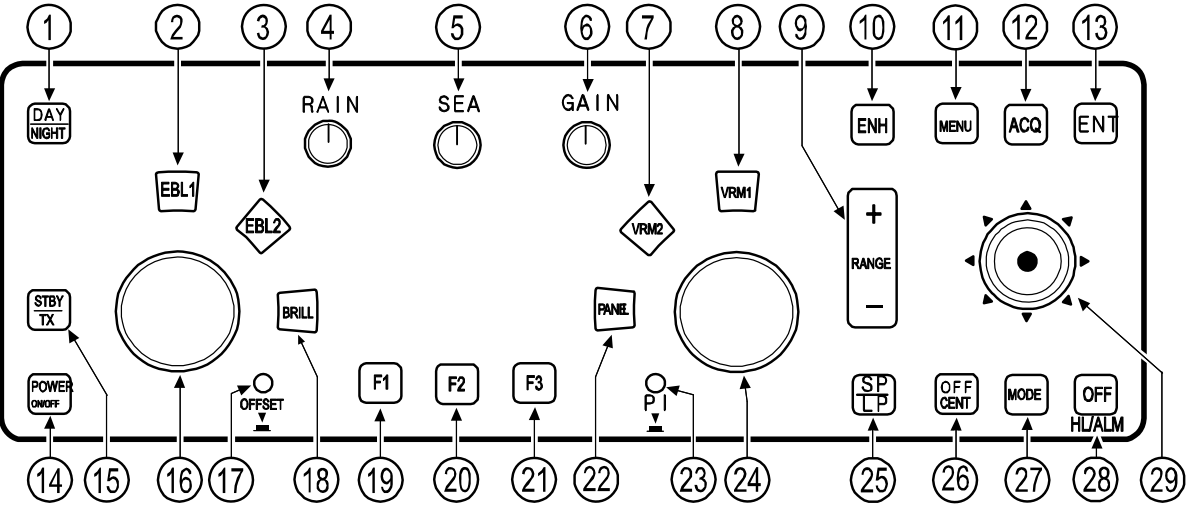
Chapter 2 Function and control names

2.1 Radar screen

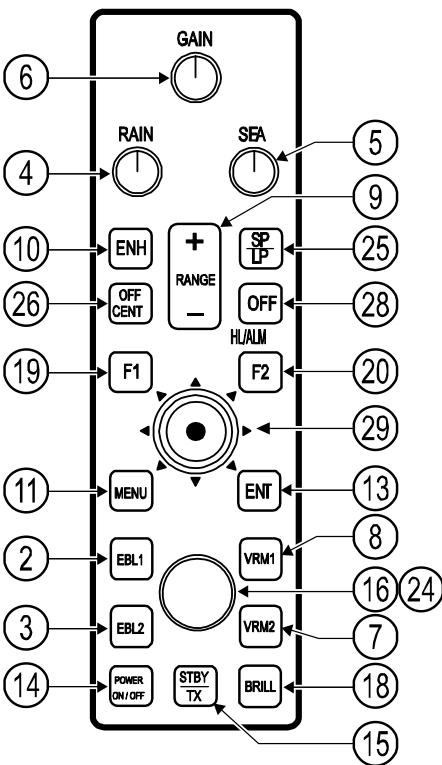


2.2 Control panel

MDC-2500 Series



MDC-2200 Series



1	[DAY/NIGHT] key
2, 3	[EBL1] [EBL2] key
4	[RAIN] knob
5	[SEA] knob
6	[GAIN] knob
7, 8	[VRM1] [VRM2] key
9	[RANGE +/-] key
10	[ENH] key
11	[MENU] key
12	[ACQ] key
13	[ENT] key
14	[POWER ON/OFF] key
15	[STBY/TX] key
16	[EBL] knob
17	[OFFSET] lamp
18	[BRILL] key
19, 20, 21	[F1] [F2] [F3] function key
22	[PANEL] key
23	[PI] lamp
24	[VRM] knob
25	[SP/LP] key
26	[OFF CENT] key
27	[MODE] key
28	[OFF] key
29	[Joystick]

- ① [DAY/NIGHT] key **Note: This function is not available for MDC-2200**
Change video and background color. 2 types of mode are provided for day and night.
- ② [EBL1] key
This key is used to switch on or off EBL1. This key is used to switch operation when EBL2 is selected and displayed.
- ③ [EBL2] key
This key is used to switch on or off display of EBL2. This key is used to switch operation when EBL1 is selected and displayed.
- ④ [RAIN] knob
This knob is used to adjust to reduce reflection of rain and snow to improve target delectability. Rain and snow reflection reduction effect is increased by turning knob to the clockwise direction. It is also used as function key by pressing knob.
- ⑤ [SEA] knob
This knob is used to adjust to reduce reflection of ripple of sea surface to improve target delectability.
Surface reflection reduction effect is increased by turning knob to the clockwise direction. It is also used as function key by pressing knob.
- ⑥ [GAIN] knob
This knob is used to adjust receiving gain to improve target delectability. Gain is increased by turning knob clockwise. It is also used as function key by pressing knob. It is also used as function key by pressing knob.
- ⑦ [VRM1] key
This key is used to switch on or off VRM1. It is also used to switch operation when VRM2 is displayed and selected.
- ⑧ [VRM2] key
This key is used to switch on or off VRM2. It is also used to switch operation when VRM1 is displayed and selected.
- ⑨ [RANGE] key
The RANGE key changes the range scale. A press of the + key or – key increases or decreases the range scale, respectively.
- ⑩ [ENH] key
Target enhance function is switched by pressing this key, [ENH 1] => [ENH 2] => [ENH 3] => Off

- ⑪ [MENU] key
Menu is turned on or off by pressing this key.
- ⑫ [ACQ] key **Note: This function is not available for MDC-2200.**
This key is used for target acquisition of ATA or EPA.
Acquired target is deleted when [OFF] and [ACQ] keys are pressed simultaneously.
- ⑬ [ENT] key
This key is used to determine designated value for menu operation. Designated value is not altered if menu is closed without pressing [ENT] key. This key is also used to select target of ATA, EPA or AIS and to select mark during mark display.
- ⑭ [POWER ON/OFF] key
This key is used to turn power on or off.
- ⑮ [STBY/TX] key
This key is used to switch on TX or standby.
- ⑯ [EBL] knob **Note: [EBL]/ [VRM] knobs are common for MDC-2200.**
This knob is used to operate EBL or to adjust screen brilliance.
Offset function is activated when this knob is pressed.
- ⑰ [OFFSET] lamp **Note: This function is not available for MDC-2200.**
This lamp is on when offset function is active.
- ⑱ [BRILL] key
This key is used to change screen brilliance.
- ⑲ [F1] function key
This key is used for function key. Function assignment is selected in startup menu.
- ⑳ [F2] function key
This key is used for function key. Function assignment is selected in startup menu.

- ②1 [F3] function key **Note: This function is not available for MDC-2200.**
This key is used for function key. Function assignment is selected in startup menu.
- ②2 [PANEL] key **Note: Panel dimmer is changed over by [BRILL] key for MDC-2200.**
This key is used to change panel dimmer.
- ②3 [PI] lamp **Note: This function is not available for MDC-2200.**
This lamp is on during parallel index line function is selected.
- ②4 [VRM] knob **Note: [EBL] / [VRM] knobs are common for MDC-2200.**
This knob is used to operate VRM or to adjust panel dimmer.
- ②5 [SP/LP] key
This key is used to change pulse length to improve target delectability.
- ②6 [OFF CENT] key
This key is used to switch on or off Off center.
- ②7 [MODE] key **Note: This function is not available for MDC-2200.**
This key is used to switch over display mode such as Head-up, North-up etc.
- ②8 [OFF] key
Heading line is erased during this key is pressed.
Alarm sound is stopped by pressing this key at the time when alarm is sounding.
Deleting operation is performed by using this key in combination with other keys.
- ②9 [Joy stick]
This device is used for cross cursor operation, menu operation, target acquisition operation or mark input operation.

Chapter 3 Basic operation (for control panel)

3.1 Power On/Off

Power On

Press [POWER ON/OFF] key. Buzzer sound [Peep] is produced and then Radar system is activated.

- After activation, the character of [Model name] and [WAIT] will be displayed and the preheating of magnetron will start.
- The brilliance of the screen is set with the brilliance set at the time when the power has been turned off.

Power Off

Keep pressing [POWER ON/OFF] key for longer than 3 sec.

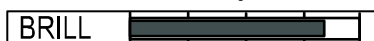
IMPORTANT: Re-entry of power shall be performed after having passed for longer than 3 sec. after power-off.

3.2 Change brilliance of display unit (Screen and Control panel)

Change screen brilliance

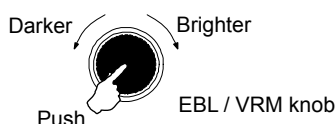
(For MDC-2200)

- 1 Press [BRILL] key. (Note: Each time [BRILL] key is pressed, it changes over "Screen brilliance" and "Panel dimmer")
- 2 Screen brilliance adjustment window is displayed.



- 3 Turn [EBL] / [VRM] knob clockwise to increase brilliance.
Turn [EBL] / [VRM] knob counter clockwise to decrease brilliance.

* The display brilliance changes in 5 steps each time by pressing [EBL] / [VRM] knob.

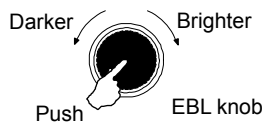


(For MDC-2500)

- 1 Press [BRILL] key.
- 2 Screen brilliance adjustment window is displayed.




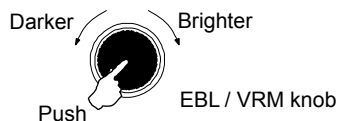
- 3 Turn [EBL] knob clockwise to increase brilliance.
Turn [EBL] knob counter clockwise to decrease brilliance.
* The display brilliance changes in 5 steps each time by pressing [EBL] knob.




Change brightness of control panel dimmer

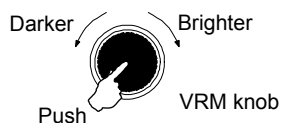
(For MDC-2200)

- 1 Press [BRILL] key twice. (Press once during screen brilliance window is displayed.)
- 2 Panel dimmer adjustment window is displayed in the screen.

- 3 Turn [EBL] / [VRM] knob clockwise to increase brightness of the panel dimmer.
Turn [EBL] / [VRM] knob counter clockwise to decrease brightness of the panel dimmer.
* The panel dimmer changes in 5 steps each time by pressing [EBL] / [VRM] knob.



(For MDC-2500)

- 1 Press [PANEL] key.
- 2 Panel dimmer adjustment window is displayed in the screen.

- 3 Turn [VRM] knob clockwise to increase brightness of the panel dimmer.
Turn [VRM] knob counter clockwise to decrease brightness of the panel dimmer.
* The panel dimmer changes in 5 steps each time by pressing [VRM] knob.



3.3 Transmission

Start transmission

Press [STBY/TX] key. Antenna starts rotating and transmission.

Transmission is not available just after the power on and [WAIT] is displayed on the screen. Wait until [STAND-BY] is displayed after timer count is completed.

Stop transmission

Press [STBY/TX] key in [Transmission] status to stop transmission.

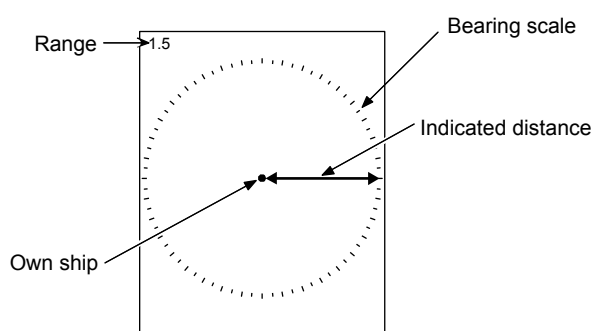
[STAND-BY] is displayed on the screen after stopping transmission.

3.4 Change range (indicated distance)

By switching over range, observing area can be changed. Set up the most suitable range for observation. The observing range is numerically displayed on the upper left of the screen.

- 1 Press [RANGE +] key to zoom out the area and to observe a long distance.

Press [RANGE -] key to zoom in the area and to magnify proximity of own ship to observe.



Ranges usable per each model are as shown below. (Standard setting)

Model name				Range
MDC-2220/2520 (Max. output : 25 kW)	MDC-2210/2510 (Max. output : 12 kW)	MDC-2260/2560 (Max. output : 6 kW)	MDC-2240/2540 (Max. output : 4 kW)	0.125NM
				0.25NM
				0.5NM
				0.75NM
				1.5NM
				3NM
				6NM
				12NM
				24NM
				48NM
				72NM
				96NM

3.5 Adjust receiver gain (GAIN)

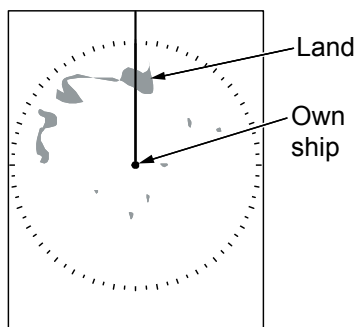
Adjust receiver gain with [GAIN] knob to obtain easy viewing screen according to observing status such as range of distance, sea surface, rain and snow clutter, etc.

- 1 Turn [GAIN] knob clockwise to increase receiving gain.
Turn [GAIN] knob counter clockwise to decrease receiving gain.

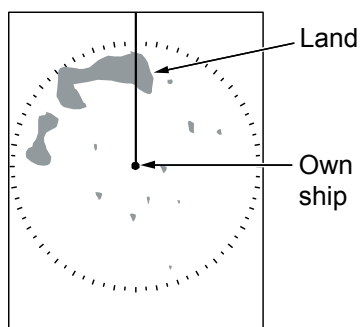


- Decrease gain to observe short range dense targets easier.
- Increase gain effectively for long range targets, however if gain is increased to much, the noise will increase accordingly and it makes difficult to observe small targets.

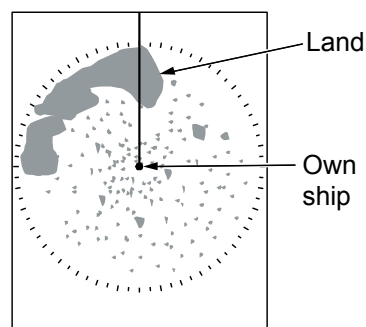
Result picture after adjustment by gain knob



< Picture of too low gain >



< Picture of moderate gain >



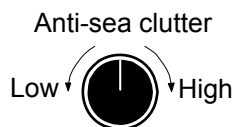
< Picture of too high gain >

3.6 Reduce sea clutter (STC)

In short distance range, the echo from the sea clutter appears on the display even in calm state. In rough seas, the echo from the sea clutter appears heavily around the center of the screen and the targets become hard to be observed.

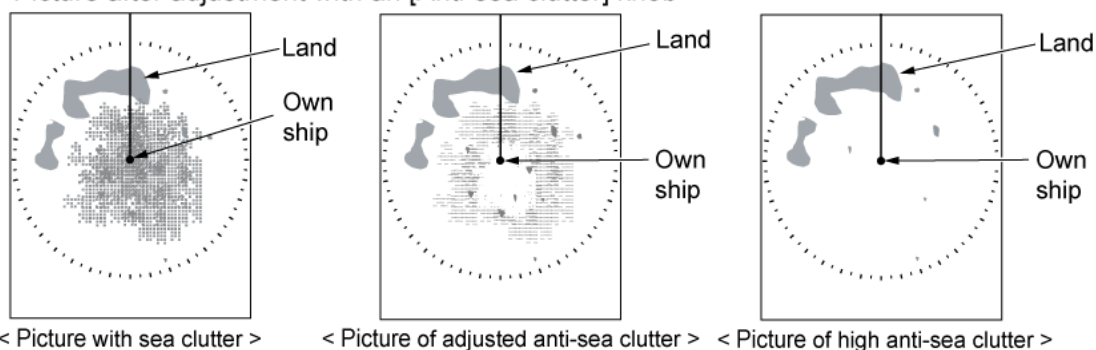
By using [SEA] knob, suppress this influence of anti-sea clutter and adjust it to make targets easier to be observed.

- 1 Turn [SEA] knob clockwise to increase anti-sea clutter effect.
- 2 Turn [SEA] knob counter clockwise to decrease anti-sea clutter effect.



- The knob shall be turned to leftmost position in a calm environment.
- This function reduces gain in shorter ranges. Pay attention that the actual targets will be lost if the knob turned clockwise too much.

Picture after adjustment with an [Anti-sea clutter] knob

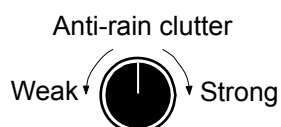


3.7 Reduce rain/snow clutter (FTC)

In rain or snow weather, targets become hard to be observed as a result of the echo from those reflections.

By using [RAIN] knob, you can suppress influence from the unwanted reflection of rain and snow and make the picture easier to be observed.

- 1 Turn [RAIN] knob clockwise to increase anti- rain clutter effect.
- 2 Turn [RAIN] knob counter clockwise to decrease anti- rain clutter effect.

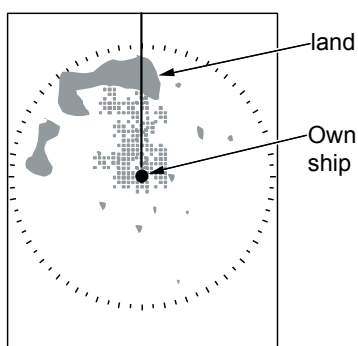


The knob should be turned to leftmost position in normal environment.

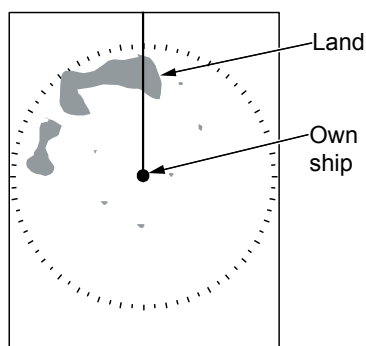
Turning the knob clockwise, profiles of targets which were hidden due to the echo of rain/snow etc. appear but pay attention not to fail to miss the small targets.

When a function to suppress ant-rain and anti-snow clutter is adjusted too high, it may prevent from detecting targets due to suppression of echo not only from rain and snow but also from the targets

Result picture after adjustment with an [Anti-rain clutter] knob



< Picture with rain clutter >



< Picture with rain reflex suppressed >

3.8 Change transmission pulse length (SP/LP)

A function capable of achieving suitable target detection by changing the transmission pulse length is provided.

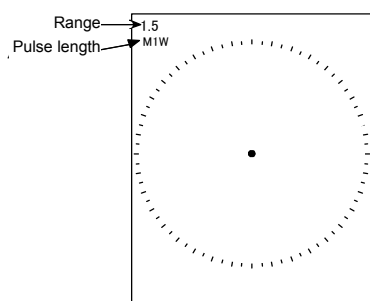
The short pulse length [SP] is suitable for dense targets due to high resolution.

The long pulse length [LP] is suitable for detection of small targets due to high gain.

Pulse length can be changed in range of 0.75nm, 1.5nm, 3nm and 6nm. (factory setting)

- 1 Press [SP/LP] key. Two types of pulse length which are suitable in that range will be changed each time by pressing key.

Current pulse length is shown upper left of the screen.



short ————— long

SP < M1W < M1N < M2W < M2N < L1P < L2P

3.9 Enhance target (ENH)

This function is intended to enhance a desired target on the screen and make the image easier to be observed.

- 1 Press [ENH] key. Each time by pressing, It switches over [ENH1] -> [ENH2] -> [ENH 3] -> [Off] .

Enhance levels are:

ENH 1: small

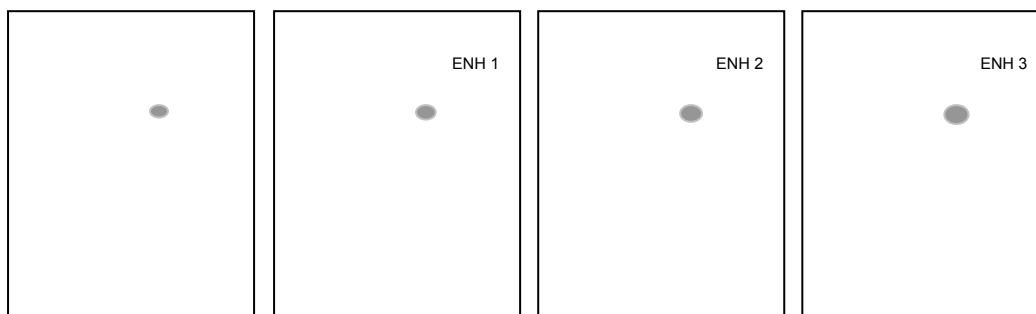
ENH 2: medium

ENH 3: large

Current selected enhance target mode is displayed on the upper right of the screen.

- Target enhance function also magnifies the echo of sea and rain clutter.

Combine to use the function of [SEA] knob and [RAIN] knob to obtain the optimized picture.



3.10 Measure distance and bearing of a target

Measure distance (VRM: Variable Range Marker)

The VRM is used to measure the distance of a target from the own ship's position and the optional position.

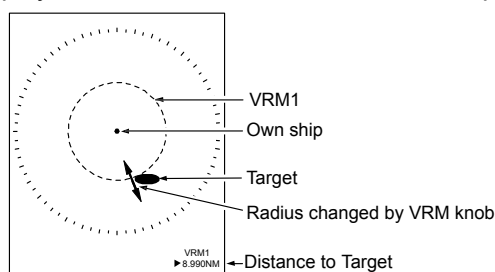
Two types, [VRM1] and [VRM2] are provided.

After selection of [VRM1] or [VRM2], Adjust [VRM] to the target by turning knob and then measure the distance.

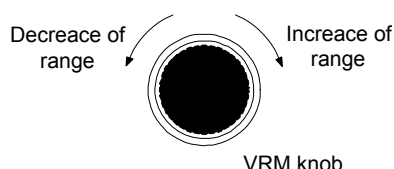
VRM can be shifted quickly when being operated by pressing the knob.

- 1 Press [VRM1] key to display a dotted line circle of [VRM1].

The distance to VRM1 is indicated on the lower right on the screen, and also a ► symbol is displayed on the left side of the distance display.



- 2 The dotted line circle is aligned to the target to be measured its distance by turning [VRM] knob. The value of distance display is the distance to the target.



- 3 Press again the [VRM1] key to turn VRM1 off. The distance display in lower right of the screen is turned off simultaneously.
- 4 Press [VRM2] key to display the broken line circle of VRM2. Operation procedure and distance display are the same procedure as for [VRM1].
- 5 Both VRM1 and VRM2 can be displayed simultaneously by pressing [VRM1] key and thereafter [VRM2] key.
- 6 Switching over of VRM1 and VRM2 are performed by pressing [VRM] key to be used.
(For MDC-2500 series. selected VRM key color changes to red.)

- The unit of VRM distance can be selected from “NM, km, sm, and RANGE LINK.

To be set up as follows: Detail menu => “ MARKER” => “ VRM1 UNIT” or “ VRM2 UNIT”



Detail menu shall be referred to “Display detailed menu” (page 4-2)” for release protection.



Refer to “Measure distance and bearing between two points (Offset)” (page 3-13) in order to offset the center point of VRM to the intended position (position of cross cursor).

Measure bearing (EBL: Electronic Bearing Line)

This is used for measuring the bearing of the target from the own ship or from the optional point.

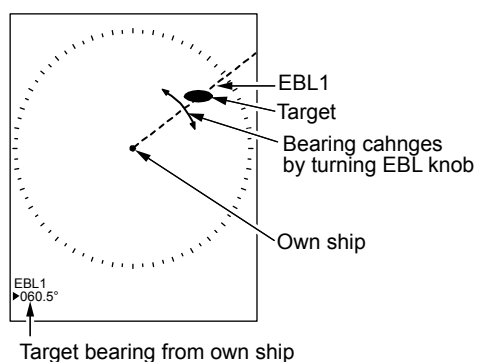
Two types of [EBL1] and [EBL2] are provided.

After selection of [EBL1] or [EBL2] by pressing either key, align electronic bearing line to the target by turning the knob and then measure the bearing.

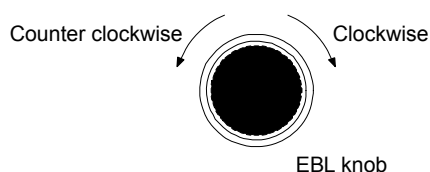
EBL can be shifted quickly when being operated by pressing the knob.

- 1 Pressing [EBL1] key, [EBL1] electronic bearing (dotted line) is displayed.

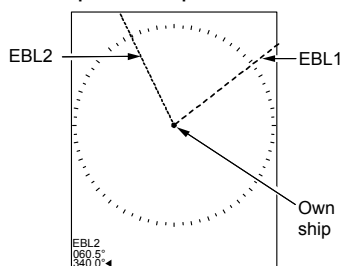
EBL1 bearing value on the lower left of the screen and a ► mark on its left are displayed.



- 2 By turning [EBL] knob, align the electronic bearing line to the target to be measured.
The value of bearing display is the bearing of the target.



- 3 Press [EBL1] key again to turn EBL1 off.
- 4 Press [EBL2] key, and [EBL2] electronic bearing (broken line) will be displayed.
The operation procedure and display of the bearing is the same as for [EBL1].



- 5 Press [EBL1] key then press [EBL2] key to display both EBL1 and EBL2.
- 6 Press [EBL] key to switch over either EBL1 or EBL2 to be used.
(In MDC-2500 series, selected EBL key color changes to vermillion.)

☞ Refer to “Measure distance and bearing between two points” (page 3-13) in order to offset EBL center point to the intended position (position of cross cursor).

Measure distance/bearing (PI: Parallel index line)

This function is used to display a parallel straight line from own ship or optional location and measure distance and bearing.

The number to be displayed of parallel index line is selectable from normal (number of the rings of the range to be used), 1 to 7 lines.

Display single side (default) or both sides of screen can be switched over.

- **Parallel index line can be shifted quickly when being operated by pressing the knob.**

(For MDC-2200)

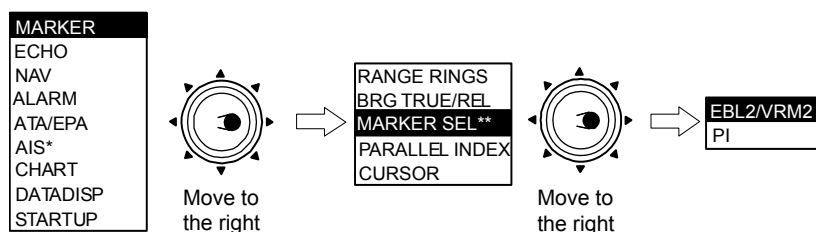
EBL2/VRM2 or Parallel index line is selectable to use in case for MDC-2200. It was set to EBL2/VRM2 in ex-factory.

Set up to Parallel index line from marker selection menu to use Parallel index cursor.

1 Setting of Parallel index cursor

Press [MENU] key to display "Menu".

To proceed "MARKER" => "MARKER SEL", set up EBL2/VRM2 to the PI, then press [ENT] key.



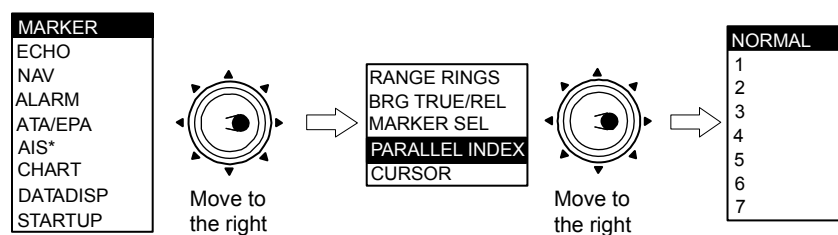
* : Displayed at installation of AIS unit (optional).

** : MARKER SEL is provided for MDC-2200 series only.

2 Display line number setting

Press [MENU] key to display "Menu".

To proceed "MARKER" => "PARALLEL INDEX", then select display number and press [ENT] key.



* : Displayed at installation of AIS unit (optional).

** : MARKER SEL is provided for MDC-2200 series only.

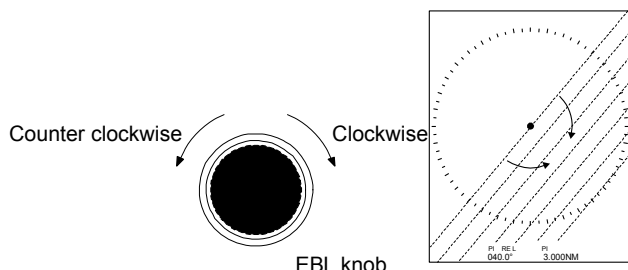
In Normal, line number is equal to number of Range ring.

Designated number of PI is displayed when 1 – 7 value is selected.

3 PI is displayed by pressing [EBL2] or [VRM2].

4 Bearing is displayed middle lower left of the screen, and distance between PI line is displayed middle lower right of the screen during PI display.

- 5** The interval between lines can be varied by pressing and rotating [VRM2] knob.
 In “Normal” setting, variable range is min: equal to Range ring one, max: 50% of selected range.
 In “1 – 7” setting, min: 0, max: about 1.6 times of selected range.
 Bearing can be varied by pressing and rotating [EBL2] knob.



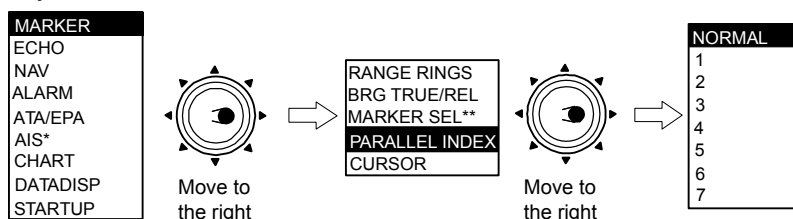
Refer to “Measure distance and bearing between 2 points (Offset)” (page 3-13) for offsetting center of Parallel index line to optional position (cross cursor position).

(For MDC-2500)

- 1** Setting of number of lines to be displayed

Press [MENU] key to display “Menu”.

To proceed [MARKER] => [PARALLEL INDEX] and select number of lines then press [ENT] key



* : Displayed at installation of AIS unit (optional).

** : MARKER SEL is provided for MDC-2200 series only.

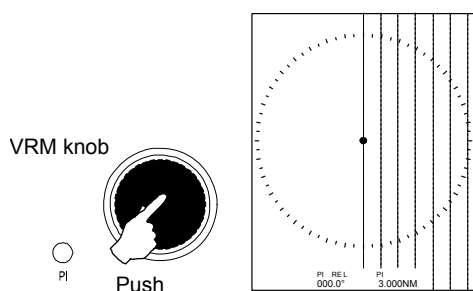
In Normal, line number is equal to Range ring one.

Designated number of PI is displayed when 1 – 7 value is selected.

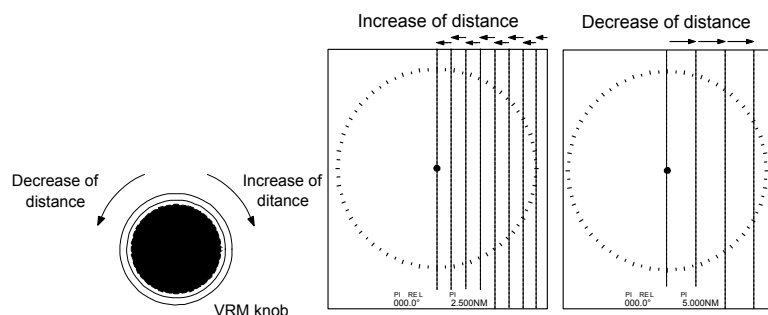
- 2** PI is displayed by pressing [VRM2] knob.

Bearing is displayed by figure on middle lower left of the screen, and distance between PI lines is displayed on middle lower right of the screen during PI display.

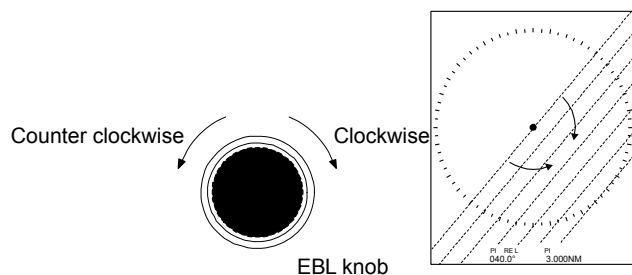
PI lamp in lower left of [VRM] knob is lighted during PI display.



- 2 The interval between lines can be varied by rotating [VRM] knob.
Though the distance may be changed freely, the setting of the interval of [VRM] can only be changed in [NORMAL] mode for the basic number of lines.



Rotate the [EBL] knob to change bearing.



- ☞ Refer to “Measure distance and bearing between two points (Offset)” (page 3-13) for offsetting the center of PI to optional position (cross cursor position).

Measure distance and bearing between two points (Offset)

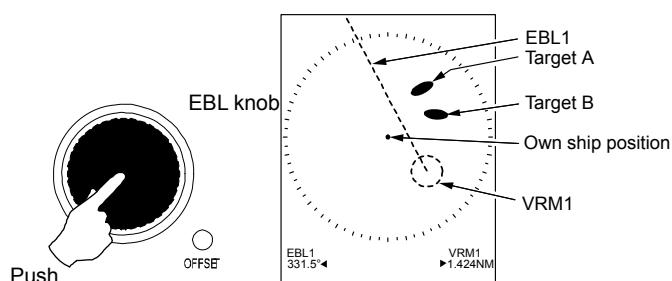
• Though VRM, EBL or PI uses the own ship as an original point for default value, this original point can be changed (offset) to the optional position. This enable to measure distance and bearing between two targets.

- The change of original point (offset) can be made for three types independently: VRM1 and EBL1, VRM2 and EBL2 and for the PI.

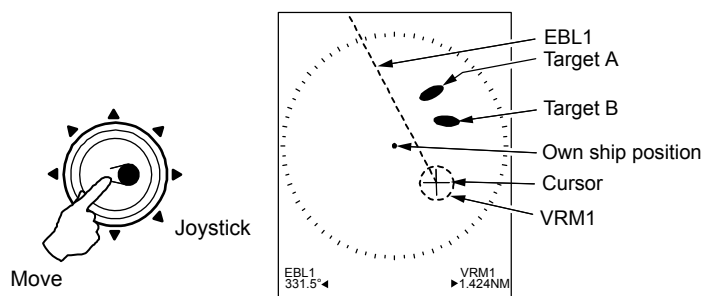
- 1 By pressing [EBL] knob while [EBL1] and [VRM1] are selected, the original points of EBL1 and VRM1 can be offset to the position of parallel index line.

Then, the numerical values of EBL and VRM displayed at lower part of the screen will change to blue.

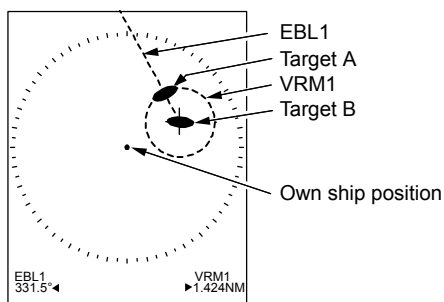
(For MDC-2500) The offset lamp color located at lower right under [EBL] knob will change to vermillion.



By operating [Joystick], the markers of EBL1 and VRM1 will move together with cross cursor.



- 2 By moving the cross cursor, point to the target B to be measured.
- 3 By turning [EBL] knob and [VRM] knob, point it to the another target A.
- 4 The bearing and distance from target B to target A are indicated as EBL1 and VRM1.



- 5 By pressing [EBL] knob after having confirmed above, the origin points of EBL1 and VRM1 will be restored to the own ship position.

- 6** For [EBL2] and [VRM2], the same procedure as that for [EBL1] and [VRM1] is taken to set up.

3.11 Change echo color (DAY/NIGHT)

This function is used to change echo colors on the screen depending on day and night navigation to make viewing easier.

The image and background color can be set independently for daytime or for nighttime, for which the echo color shall be registered beforehand.

(For MDC-2200)

- 1** Press [MENU] key to display "Menu".
Select [ECHO] => [DAY/NIGHT] and select Day echo or Night echo color then press [ENT] key.

(For MDC-2500)

- 1** Press [DAY/NIGHT] key to switch over Echo color to Day echo and Night echo alternatively.

The above can be operated by using Menu.

3.12 Remove the heading line

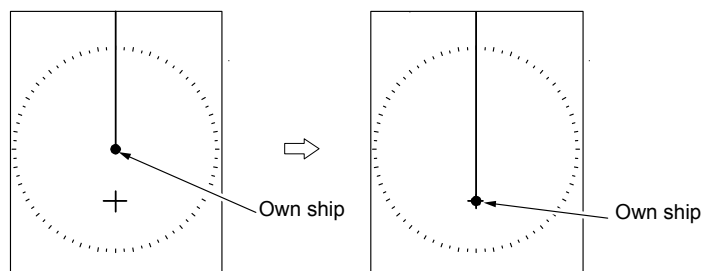
This function is used when a target is overlapped with a heading line and hard to be observed.

- 1** Press [OFF] key to temporarily hide the heading line.
A target toward on the heading line becomes easier to observe while the key is kept being pressed. (It is not possible to remove it continuously.)
There is a function to make heading line blinking without key operation. (Detailed menu=> [MARKER] => [HL BLINK] => ON)

3.13 Relocate own ship position (Off-centering)

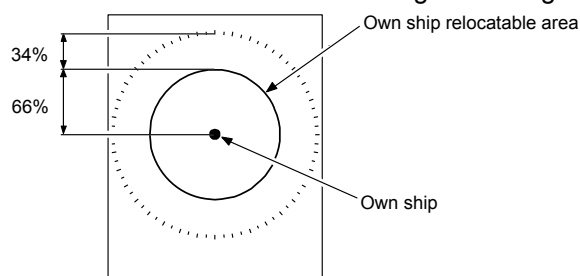
This function is used to get broad outlook of heading line by relocating position of own ship.

- 1 Move a cross cursor to the position you want to move own ship by operating [Joystick].
- 2 Press [OFF CENT] key to move own ship to cross cursor position.



- 3 Press [OFF CENT] key again to return own ship to the center of the screen.

Off center area is limited to 66% of the designated range.



Off center position can be fixed to stern orientation instead of cross cursor position.

(Chapter 4 4.3 ECHO menu => [OFF CENTER POSITION] => OPPOSITE)

3.14 Select display mode

The display mode is combined with bearing display mode and target motion display mode.

The bearing display mode is provided with 3 types: [HUP], [CUP] and [NUP].

The target motion display mode is provided with 2 types: [RM] and [TM].

Following 5 display modes are provided for this device with combination of these modes described above.

H UP_{RM}

C UP_{RM}

C UP_{TM}

N UP_{RM}

N UP_{TM}

- Input bearing signal to use C UP_{RM} and N UP_{RM} display mode.
- Input of both bearing and speed signal to use C UP_{TM} and N UP_{TM} display mode.

(For MDC-2200)

- 1 Press [MENU] key to display "Menu".

Select [ECHO] => [DISP MODE] then select from H UP_{RM}, C UP_{RM}, C UP_{TM}, N UP_{RM}, N UP_{TM}.

Display mode is shown on the upper left of the screen.

(For MDC-2500)

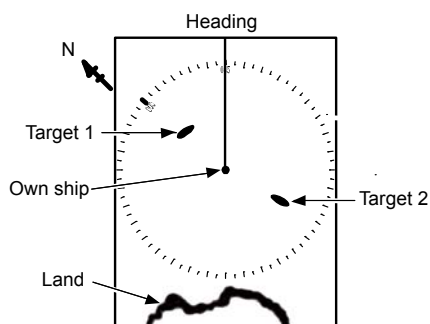
- 1 Press [MODE] key. The display mode will be changed in the following order each time you press [MODE] key. Current display mode is displayed on the upper left of the screen.



For H UP (Head up mode)

Heading line bearing is always displayed to the direct top of the screen.

This mode is based on bow of the ship and is suitable to watch targets because the range of view is the same as that at the time of ship handling.



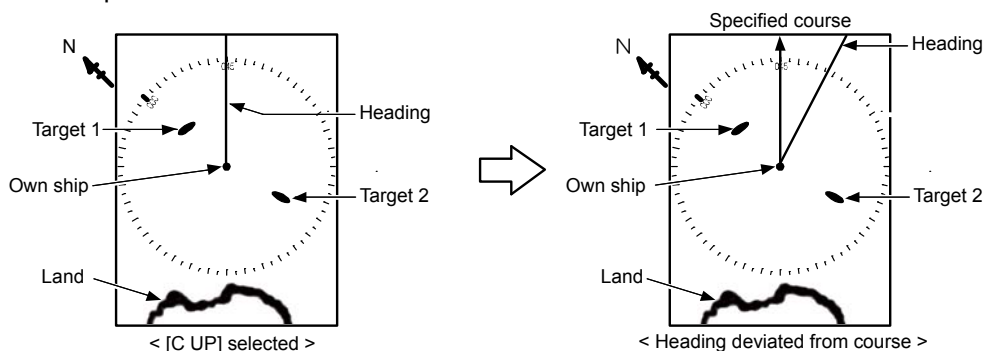
For C UP (Course up mode)

When "C UP_{RM}" or "C UP_{TM}" is selected, the heading line is set to the course and the setup course is shown on direct top of the screen.

This mode is used for navigation along the setup course.

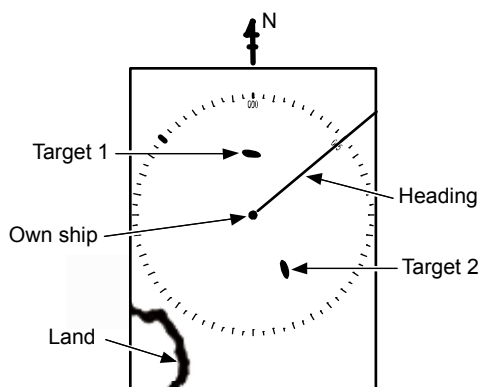
When heading is changed from the setup course after C UP setting, heading line is shown deviated accordingly from the setup course.

To navigate along the setup course, ship handling shall be done to keep heading line displayed on direct top of the screen.



For N UP (North up mode)

This mode always keeps displaying true north on the top of the screen. It makes easy to consult with the chart because of the display oriented to a true north.



For relative motion (RM) and true motion (TM)

Relative motion indicates the motion of surrounding targets with own ship's position fixed at the center of the screen.

Because own ship position is centralized, fixed targets such as the land also move on the display while the ship is moving.

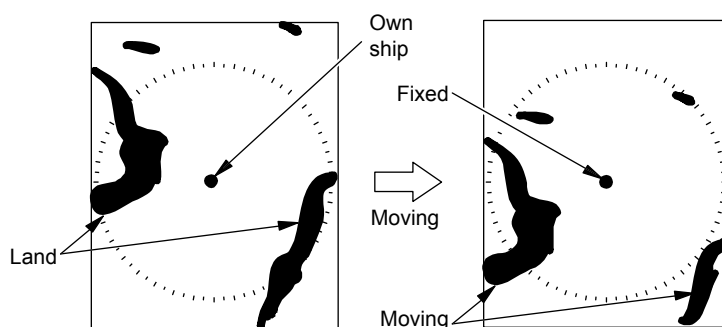
True motion indicates the motion of the target as a center of the specified bearing.

Fixed targets that do not move in any direction stay on the display as they were and actually moving targets move on the screen.

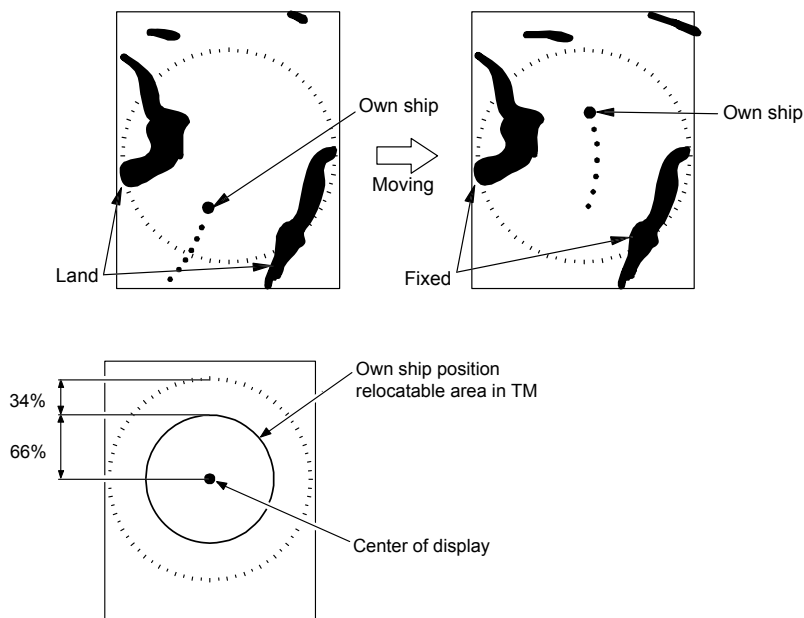
*No true motion [TM] is available for [H UP] mode because the heading always continues to move.

Relative motion (RM): The own ship position is fixed and the other surrounding targets move on the screen.

This is useful for monitoring the surrounding situation from the own ship's position as a center.

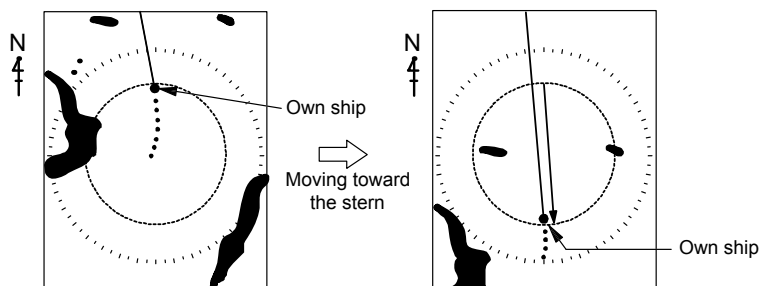


True motion (TM): Own ship's position moves according to its speed and its course on the screen. Stationary targets are fixed on the screen, while moving targets move on the screen. This mode is useful for monitoring your position from the fixed targets such as a land etc.



Reset true motion

When own ship position reaches to about 66% of effective screen radius, own ship position is automatically reset to opposite orientation of the screen.



- It is also possible to reset own ship position before it reaches to 66% of effective screen radius.

- 1 Press [MENU] key to display "Menu".
Select [ECHO] => [TM RESET] and then press [ENT] key.

3.15 Use ATA/EPA

ATA (Automatic tracking aids) function provides to acquire up to 50 targets of ship manually (specifically select target) or automatically (in prior setting area) then to track automatically.

EPA (Electronic Plotting aids) function provides calculation of course and speed of the target based on the information of 2 point position data manually acquired and the information acquired again after 30 seconds or later.

This device is equipped with ATA board as a standard. ATA function is automatically selected at the time of shipment.

The tracking data of ATA/EPA can be displayed in data display area on the lower part of the screen.

There are following information necessary to avoid collision.

CPA (Closest Point of Approach) Minimum approach point to the target (distance)

TCPA (Time to Closest Point of Approach) Time to Closest Point of Approach

Speed of the target

Course of the target

Vector of the target

- Heading bearing and speed input by optional GPS compass or equivalent is required to input to use ATA/EPA function.
- Object acquired and started tracking is called "Target".

Item	ATA	EPA
Manual acquisition	Yes	Yes
Auto acquisition	Yes	No
Tracking method	Automatic	Manual
Max. tracking number	50	50

(ATA operation method)

Manual acquisition

(For MDC-2500)

- 1 Move cross cursor using [Joystick] to lay on the target to be acquired, and then press [ACQ] key. A symbol is displayed at location of the cursor.

"f" mark is displayed immediate after acquisition then changes to ○ mark after about 30sec.

Target number is attached beside the mark.

(For MDC-2200)

- 1 Move cross cursor using [Joystick] to lay on the target to be acquired, and then press [F2] key ^{Note}
1. A symbol is displayed at location of the cursor.

"f" mark is displayed immediate after acquisition then changes to ○ mark after about 30 sec.

Target number is attached beside the mark.

(Note 1) In MDC-2200, [F2] key is assigned to "ACQ" at the factory setting. The setting can be made to

other Function key.

Delete target (Select and delete)

(For MDC-2500)

- 1 Move cross cursor using [Joystick] to lay on the target to be deleted and then press [ACQ] key by pressing [OFF] key.

(For MDC-2200)

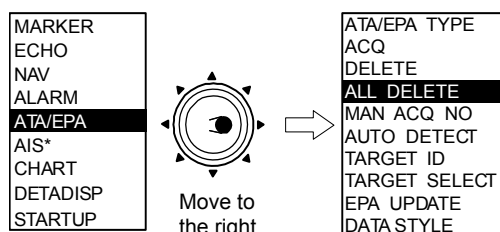
- 1 Move cross cursor using [Joystick] to lay on the target to be deleted and then press [F2] key by pressing [OFF] key.

(Note 1) In MDC-2200, [F2] key is assigned to “ACQ” at the factory setting.

Delete all targets

This function is used to delete all acquired targets.

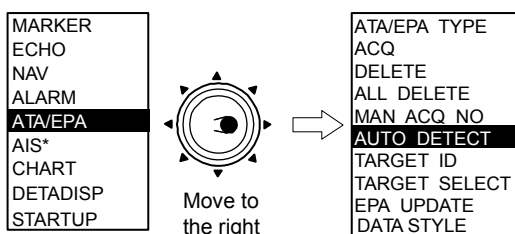
- 1 Press [MENU] key to display “Menu”.
Select [ATA/EPA] => [ALL DELETE], and then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

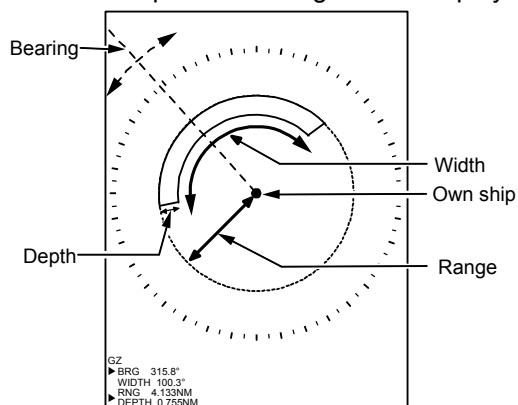
Use Automatic acquisition (Up to 40 targets can be acquired in default)

- 1 Press [MENU] key to display “Menu”.
Select [ATA/EPA] => [AUTO DETECT], and then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

- 2** ATA auto acquisition setting area is displayed on the screen.

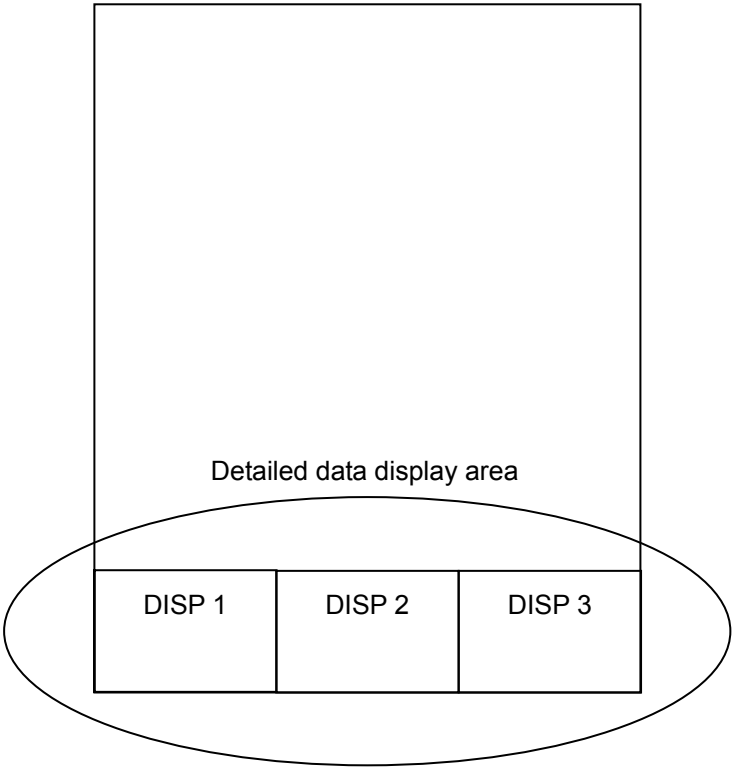


- Setting items are [BRG], [RNG], [WDT] and [DPT].
 - Value less than 5° for Bearing, 0.1NM for Depth is unavailable to set up.
 - Use [VRM] knob and [EBL] knob for setting.
- 3** Press [EBL1] or [EBL2] key, and then change [BRG] <=> [WIDTH] by using [EBL] knob.
In the same way, Press [VRM1] or [VRM2] key, and then change [RNG] <=> [DPPTH] by using [VRM] knob.
- In figure display on the lower left of the screen, Item under setup is indicated by left ► mark.
- 4** Setup process is completed by pressing [ENT] key after the area designation, then auto acquisition starts.
- To switch auto acquisition off, display the same Menu then select Auto acquisition and press [ENT] key.
 - To change auto acquisition area, off acquisition once, then restart from procedure 1. Setting area is recorded.

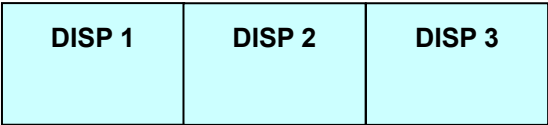
Detailed target data display method

Detailed target data can be displayed on the lower part of the screen.

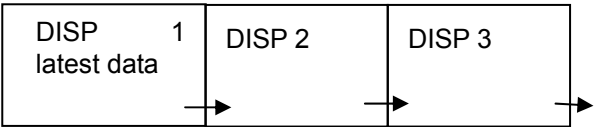
- 1** Press [MENU] key to display “Menu”.
Select [DATADISP] => [DISP 1] / [DISP 2] / [DISP 3] then turn Joystick to right.
Select ATA/EPA then press [ENT].



- 2** Data display part background is set transparent in default.
Setup by following procedure to fill background to ease to see data.
Press [MENU] key to display “Menu”.
Select [DATADISP] => [LOWER DISP BACK] then set to [ON].



- 3** When 3 target data is displayed in the detail data display area. When need to switch to display for more than 4 targets, lay cursor on target to display then press [ENT] key.
Selected target data will be displayed in left display part. Old data will be shifted to right and the old data displayed to the right will disappear.



Other setting

1 Setup vector length MENU => NAV => VECTOR

Setting value : OFF, 30sec, 1min, 3min, 6min, 12min, 30min, 60min.

- This item is to set vector length.
- Vector is a line that represents course and speed of tracking target. Orientation of the line denotes course while length of the line denotes speed.

For example when designates 1 min, the leading edge of vector points predicts position after 1min.

2 Vector mode MENU => NAV => TRUE/REL

Setting value : Relative, True

- This item is to set vector display mode: Relative or True.
- True motion displays course and speed of the target actually moving, while relative motion displays relative course and speed of the target seen from the own ship's position.

In true vector mode, vector orientation is true course of target and length is proportional to its speed.

Own ship vector is also displayed in true vector mode.

Relative vector display does not show real motion of the target but show relative motion to the own ship.

Target with its vector orientated to own ship is dangerous ship.

Accordingly, true vector is used for grasping actual situation of target while relative vector to grasp CPA of target.

3 CPA (Closest point to approach) setting MENU => ALARM => LIM CPA

Setting value : 0.0 to 19.9NM

- This item is to set closest range from own ship.

4 TCPA (Time to Closest point of approach) setting MENU => ALARM => LIM TCPA

Setting value : 1 to 63min

- This item is to set time to the closest range from own ship.

When the a target becomes into setting value of both CPA and TCPA area, it is regarded as

dangerous target and change to Δ symbol mark. In addition, this symbol mark blinks in every 1

second and sounds alarm in every 0.5 second.

Alarm can be stopped by pressing [OFF] key.

5 Manual acquisition setup MENU => ATA/EPA => MAN ACQ NO

Setting value : 0 to 50

- This item is to designate manually acquiring target number out of total 50 targets.
- Pay attention when manual acquisition number is set to 50, auto acquisition is not available to use.

EPA operation method

- 1 Move the cross cursor with [Joystick] to lay on the desired target.

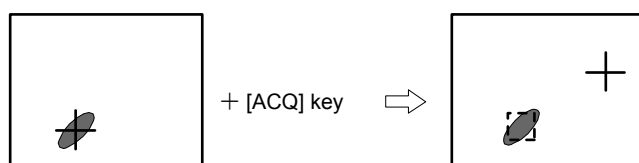
(For MDC-2500)

Press [ACQ] key on the upper right of the operating panel. The symbol of starting acquisition is overlaid on the target.

(For MDC-2200)

Press [F2] key ^{Note1}. The symbol of starting acquisition is overlaid on the target.

(Note 1) In MDC-2200, [F2] key is assigned to "Acquisition" at the setting in factory.

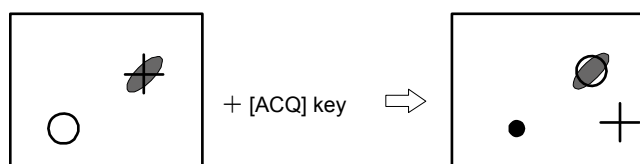


Note : When acquiring 2 or more target (up to 50), select target number by using Menu then start operation.

- 2 After 30second passed, lay cross hair cursor on moved target then press [ACQ] key ([F2] key for MDC-2200) again.

Note : When acquiring 2 or more target (up to 50), select target number by using Menu then start operation.

- The symbol moves to the latest target position and its course and speed are displayed by vector.
- Up to 5 history track points are shown on the display with [•] symbol.



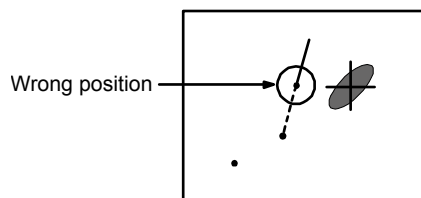
- 3 As the symbol moves according to the latest vector data, periodic use of procedure 2 above, allows the symbol to keep tracking the target which changes its speed and heading.

- If no additional manual tracking is done within 10 min and over, the EPA reliability is judged to have been lost and the symbol stops tracking.
- If no additional manual tracking is performed within 15 min and over , tracking is deleted automatically.

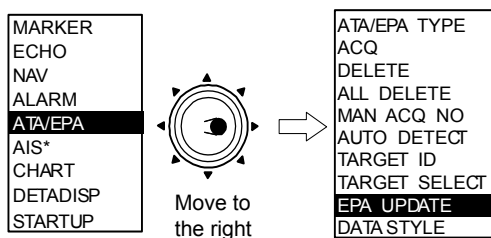
Update EPA

This function is used to correct the latest tracking point.

- 1 Move a cursor to the point to be corrected by using [Joystick].

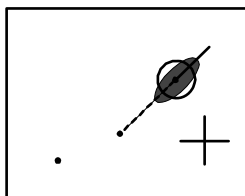


- 2 Press [MENU] key to display "Menu".
Select [ATA/EPA] => [EPA UPDATE], and then press [ENT] key.










* : Displayed at installation of AIS unit (optional).

- 3 Update tracking setup.



Types and meaning of ATA/EPA symbol

The following symbols are overlapped on ATA acquisition target.

Normal symbol		Meaning
		Displayed on acquisition setup.
		Displayed in steady tracking state.
		Displayed at indicating numerical value after steady tracking
Alarm symbol		Meaning
	Blink in 0.5 sec. interval	Displayed when above steady tracking symbol has under run both specified CPA and TCPA value.
	Blink in 0.5 sec. interval	Displayed when above indicating numerical value symbol has under run both specified CAP and TCPA.
		Displayed when the tracked target is out of tracking, and then the alarm sounds. Both display and sound disappear in 15 sec.
		Displayed when it enters the guard zone. The display disappears after it exits guard zone.

3.16 Use F (Function key)

This device is provided with F (Function).

Function key can be operated easily when assigned functions to the function key.

It has following keys in the function keys.

For MDC-2200 F1, F2, "SEA" "RAIN" and "Gain"

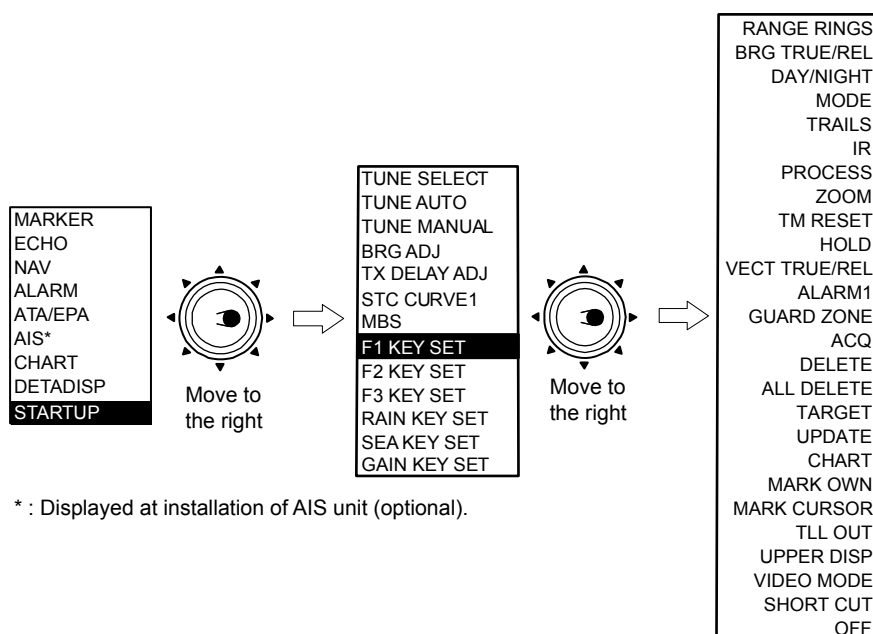
For MDC-2500 F1, F2, F3, "SEA" "RAIN" and "Gain"

(Key functions of "SEA" "RAIN" and "Gain" are available by pressing each knob) ,

Assignment method of function key

- 1 Press [MENU] key to display "Menu".

Select [STARTUP] => [F1 KEY SET], and then press [ENT] key after selecting assignment item.



- 2 The same procedure as step 1 is applied for [F2 KEY SET], [F3 KEY SET], [RAIN KEY SET], [SEA KEY SET] and [GAIN KEY SET] by selecting each item and pressing the [ENT] key.

For short cut menu

"Short cut menu" of arbitrary menu screen which has no assignment item to the function key can be set up. The set up screen menu can be displayed immediately by pressing function key.

The operation becomes easy if sub-menu in the detailed menu is set up.

Setting method of short cut

- 1 Select short cut menu by using function key (for example [F1] key).
- 2 Display arbitrary menu to be set by operating menu..
- 3 Press [OFF] key + [F1] key.
- 4 The setup is complete when beeping the buzzer for about 2 seconds.
- 5 Press [F1] key under the state of menu being deleted. Then the assigned short cut menu will be displayed immediately.

Position data output


Function key provides the function to output latitude & longitude information of arbitrary position on the radar screen. This position information is displayed as the mark on the plotter screen by connecting to the plotter device.

This information is output as TLL sentence.

Following 2 methods are available for the operation of latitude & longitude output.


Output latitude & longitude information of cross cursor position.

- 1 Select Detailed Menu => [I/O] => [OUTPUT(J4,J5)] => [TLL OUT] => [TARGET]
- 2 Set up [TLL OUT] to a Function key.
- 3 Move cross cursor to the position to output information, then press [TLL OUT] of function key.
The data of cross cursor position will be output, each time one presses function key.

 Refer to “Display detailed Menu” (Page 4-2) for Detailed Menu operation.

Input mark into own ship position or cross cursor position and output latitude & longitude information.

- 1 Select Detailed Menu => [I/O] => [OUTPUT(J4, J5)] => [TLL OUT] => [MARK].
- 2 Assign [MARK OWN] or [MARK CURSOR] to Function key. 2 Function keys can be assigned as [MARK OWN] and [MARK CURSOR] respectively.
- 3 Mark is input into own ship position and own ship position data is also output by pressing [MARK OWN] function key.
Mark is input into cross cursor position and the data of cross cursor position data is output by pressing [MARK CURSOR] function key.

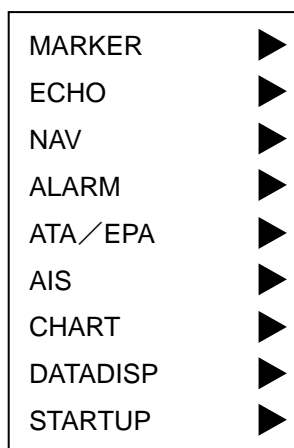
 Refer to “Display detailed Menu” (Page 4-2) for Detailed Menu operation.

Chapter 4 Menu operations

4.1 How to see and use Menu

Display menu (main menu)

Press [MENU] key then Main menu is displayed on the lower left of the screen.



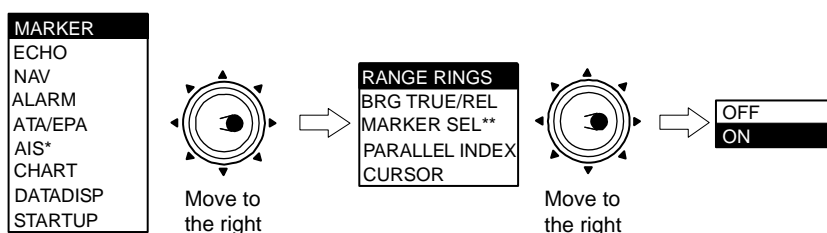
Delete menu

Menu is disappeared by pressing [MENU] key when "Menu" is displayed.

Select menu item

- 1 Select Main menu item by turning [Joystick] up or down after Main menu is displayed. (Selected item is displayed in reverse)
- 2 Sub menu is displayed by turning [Joystick] to the right after Main menu item is selected.
- 3 Turn [Joystick] up or down to select sub-menu item.
- 4 Turn [Joystick] to the right after sub-menu is selected, then next sub-menu will be displayed.
- 5 Turn [Joystick] to the left to return previous menu.

< Menu operating procedure >



* : Displayed at installation of AIS unit (optional).

** : MARKER SEL is provided for MDC-2200 series only.

Press [ENT] key.

Determine setting

Select item in sub-menu and designate numerical value or select item and then press [ENT] key.

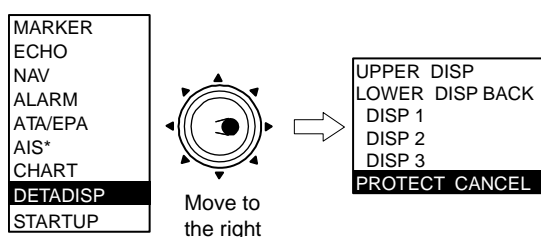
IMPORTANT: Designated value is not altered when Menu is closed without pressing [ENT] key.

Display detailed menu

As this device supports much functions, menu configuration is constructed in 2 levels (main menu and detailed menu). Main menu is displayed in normal operation. (Basic menu operation is available in this menu.)

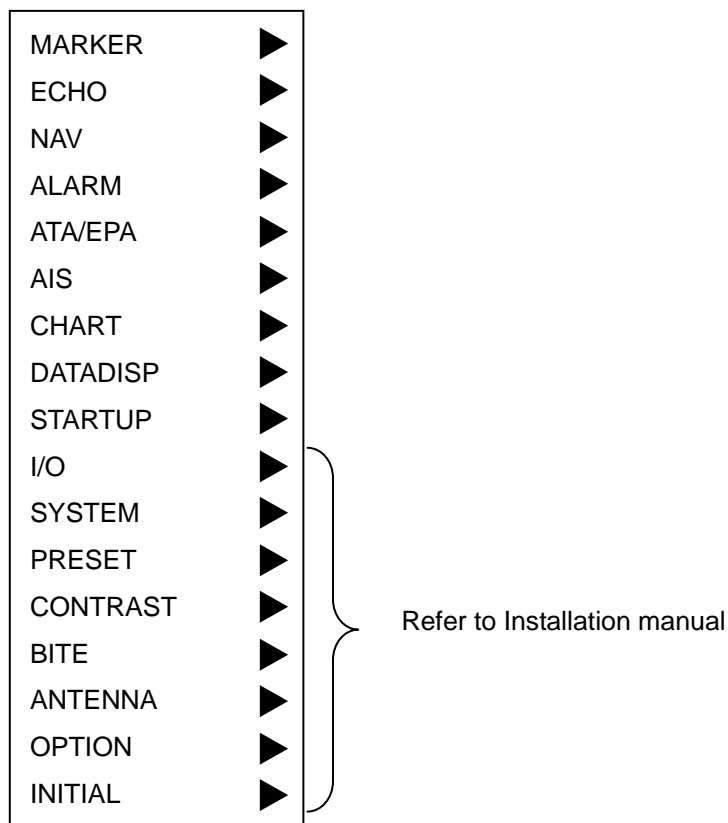
Detailed menu is displayed by following operation.

- 1 Press [MENU] key to display "Main menu". Select "DATADISP" => "PROTECT CANCEL" and then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

- 2 Press [MENU] key again. Then, detailed "Menu" below will be displayed.



- Refer to the last section of this chapter for detailed Menu list.

4.2 MARKER menu

Following designation items are provided in Marker menu.

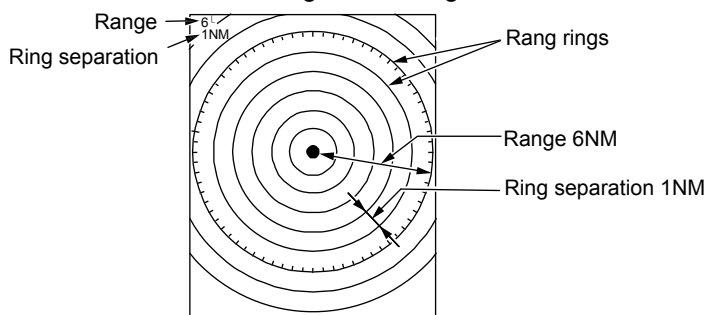
Shaded item are displayed in detailed menu.

(1)	RANGE RINGS	OFF / ON
(2)	BRG TRUE/REL	REL / TRUE
(3)	MARKER SEL	EBL2/VRM2 / PI
(4)	PARALELL INDEX	NORMAL / 1 - 7
(5)	PI DISPLAY SIDE	ONE / BOTH
(6)	CURSOR	OFF / ON / L/L
(7)	VRM1 UNIT	NM / km / sm / RANGE LINK
(8)	VRM2 UNIT	NM / km / sm / RANGE LINK
(9)	PI UNIT	NM / km / sm / RANGE LINK
(10)	STERN MRK	OFF / ON
(11)	CURSOR SHAPE	Select cursor shape
(12)	TRACKING CURSOR	OFF / ON
(13)	HU MOVE	OFF / ON
(14)	VRM/EBL CROSS	OFF / ON
(15)	SCALE	OFF / ON
(16)	CHARA	OFF / ON
(17)	CHARA POSI	IN / OUT
(18)	CHARA TYPE	NUMERIC / SYMBOL
(19)	HL BRINK	OFF / ON
(20)	GUARD LINE	OFF / ON, designate line width
(21)	OS OUTLINE	OFF/ON
(22)	OS PROFILE	SET PROFILE
(23)	SHIP'S PROFILE	OFF / ON, SET SHIP'S PROFILE

(1) Display Range rings

Range rings is the marker to display fixed distance from own ship position.

It is used to measure range to the target.



(2) Set bearing mode (relative/true mode)

Bearing display mode of [EBL], [PI], [BRG SCALE] and [CROSS CURSOR] can be set at either relative or true mode.

Relative bearing mode defines heading line at 0 degree while true bearing mode defines true north at 0 degree to display bearing of EBL, PI, BRG SCALE and CROSS CURSOR.

IMPORTANT: Heading signal shall be input by using GPS compass etc. to display with true bearing mode.

IMPORTANT: True bearing mode is switched to relative bearing mode when heading signal is intermitted.

(3) Marker selection (MDC-2200 only)

Switch over operation mode of EBL2/VRM2 key.

“EBL2/VRM2” or “Parallel index” can be selected.

 Refer to “Measure distance/bearing (PI: Parallel index line)” (Page 3-10).

Parallel index is activated by pressing EBL knob for MDC-2500.

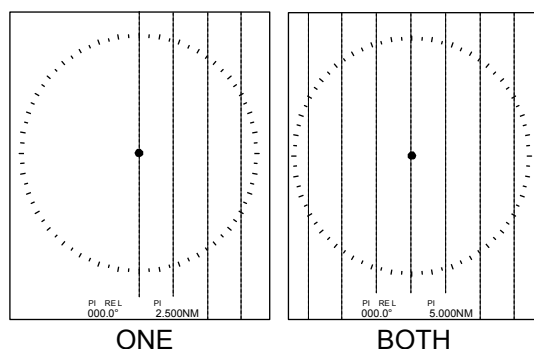
(4) Designate display lines of Parallel index.

Designate display lines of Parallel index.

 Refer to “Measure distance/bearing (PI: Parallel index line)” (Page 3-10).

(5) Designate display direction of Parallel index

Parallel index can be displayed in one or both side based on the view from own ship.



(6) Designate cross cursor display method.

Information of cross cursor (bearing and range from own ship position) is displayed on the lower right of the screen.

This information includes bearing and range from own ship position and latitude/longitude of cursor position.

(Display latitude/longitude of cursor position)

Select [MARKER] => [CURSOR] => [L/L], then press [ENT].

Select setting item [ON] then press [ENT] key to stop latitude/longitude display.

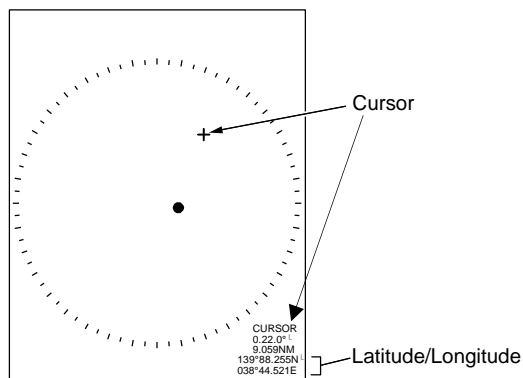
IMPORTANT: Heading signal and latitude/longitude signal shall be input to display latitude/longitude.

- Cursor display is turned off normally and when operated only with joystick, cursor can also be displayed.

(Display only when cursor is in use)

Select [MARKER] => [CURSOR] => [OFF], then press [ENT] key.

Select setting item [ON], then press [ENT] key to keep cursor displayed.



< Display content of setting item >

OFF : Cursor is displayed only when joystick is operated.

ON : Cursor is always displayed.

L/L : Display bearing/distance from own ship position and latitude/longitude.

(7) VRM1 Setting of range unit

VRM1 range unit can be changed. (NM, km, sm, RANGE LINK)

By setting RANGE LINK, the same unit as the display range of radar image is set.

(8) VRM2 Setting of range unit

VRM2 range unit can be changed. (NM, km, sm, RANGE LINK)

By setting RANGE LINK, the same unit as the display range of radar image is set.

(9) PI Setting of range unit

PI range unit can be changed. (NM, km, sm, RANGE LINK)

By setting RANGE LINK, the same unit as the display range of radar image is set.

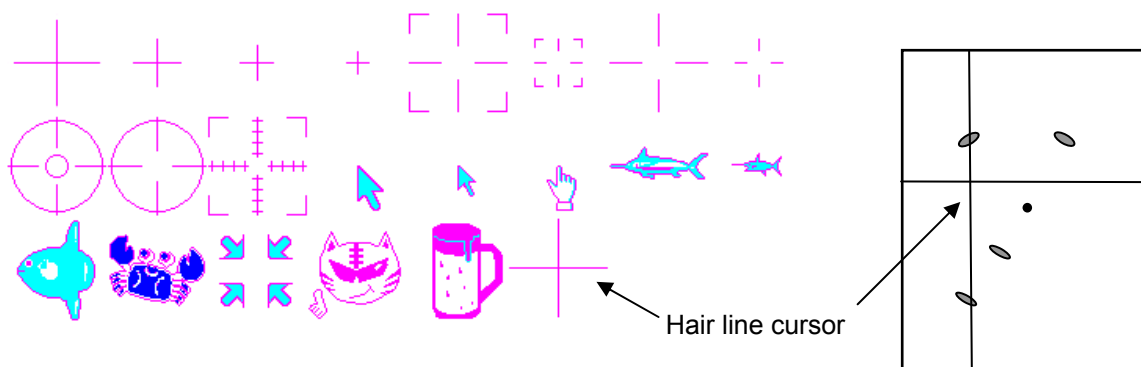
(10) Display stern marker

This function is to display marker in opposite side of heading line (stern direction).

(11) Setting of cursor shape

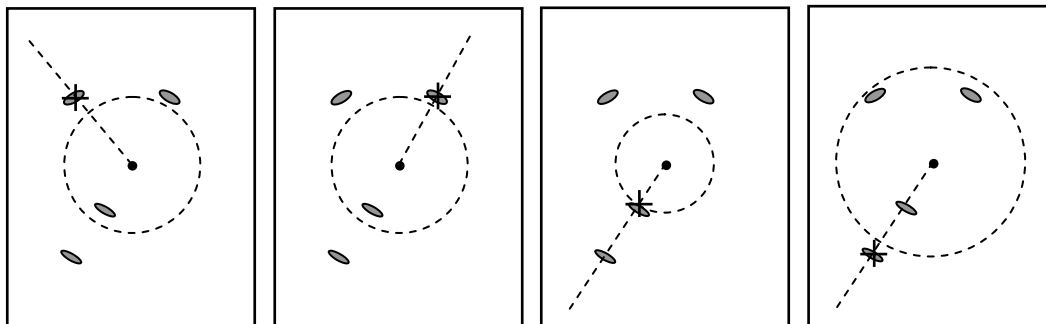
Cross cursor shape can be changed as desired. Select out of 22 types of shape.

Lowest [+] is hair line cursor ,which can be displayed up to extreme top, bottom, right and left of the screen.

**(12) Tracking cursor**

Tracking cursor is the function to have position of cross cursor moved onto the target nearest to intersection of EBL1 and VRM1, interlocking with the movement of EBL1 and VRM1. Acquisition operation of ATA/EPA can be performed without using joystick.

This function is effective when joystick operation is difficult under violent sea weather.



(13) HU bearing interlocking

Cross cursor position is changed interlocking with own ship bearing change in H UP display mode.

It eases ATA/EPA target acquisition, AIS target selection and mark select operation even when bearing is being changed.

(14) Display VRM/EBL intersection

Display mark on the intersection of EBL and VRM when both are displayed simultaneously. It is a effective function to use when measuring range and bearing of the target.

Round mark is displayed on the intersection of EBL1 and VRM1, and also on the intersection of EBL2 and VRM2.

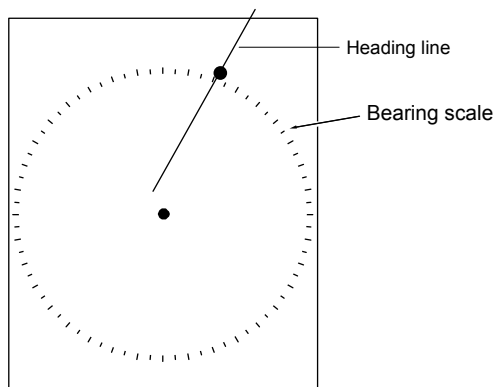
When both EBL1 and EBL2 are displayed at the same time, the following symbol will be displayed.

- mark at selected intersection;
- mark for unselected intersection.

(15) Display bearing scale

Display bearing scale on the outer circumference of effective radar screen.

- mark is displayed intersection of heading line and bearing scale.

**(16) Display bearing in numerical value or with symbol on the bearing scale**

Display bearing numerically (000 to 350: 10 degree interval) or symbolically (N, NE, E, SE, S, SW, W, NW).

When item (2) bearing mode is relative, heading bearing is "000" or "N".

When item (2) bearing mode is true, true north bearing is "000" or "N".

Refer to "item (18) Select display format".

(17) Select bearing display location

Select bearing numerical or symbolical location on bearing scale.

Select display location either inner or outer of the bearing scale.

(18) Select display format

This function is to select format (numeric or symbol) to show bearing on bearing scale.

Refer to "item (16) Display bearing".

(19) Use blinking of heading line

This function is to blink heading line (and stern line) per each antenna rotation.

It is effective to observe small target on the heading line.

(20) Display guard line

This function is to display parallel lines to the heading on both side of own ship position.

Distance to guard line from own ship can be set at 0 to 10000m (left and right side independently).

(21) Display own ship's outline

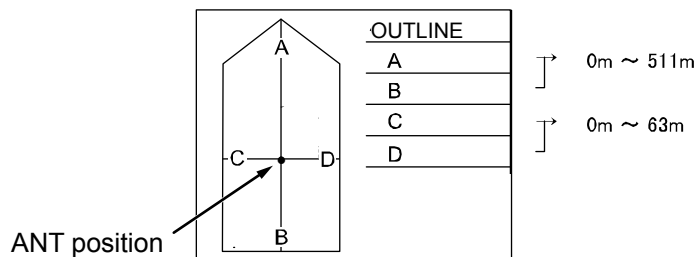
Set up On/Off of own ship's outline display.

(22) Setup own ship's profile (Cannot use on transmitting)

Press [MENU] key to display "Menu".

Select [MARKER] => [OS PROFILE] =>

Specify the each numerical value based on the antenna position.



*The center of echo image (PPI) is ANT.

(23) Display/generate own ship's profile

This function is to generate own ship's profile and to display on the screen.

Generate and input own ship's profile by using up to 50 lines.

Display own ship's profile: ON, OFF

Profile setting : X1 : -1000 to 1000m

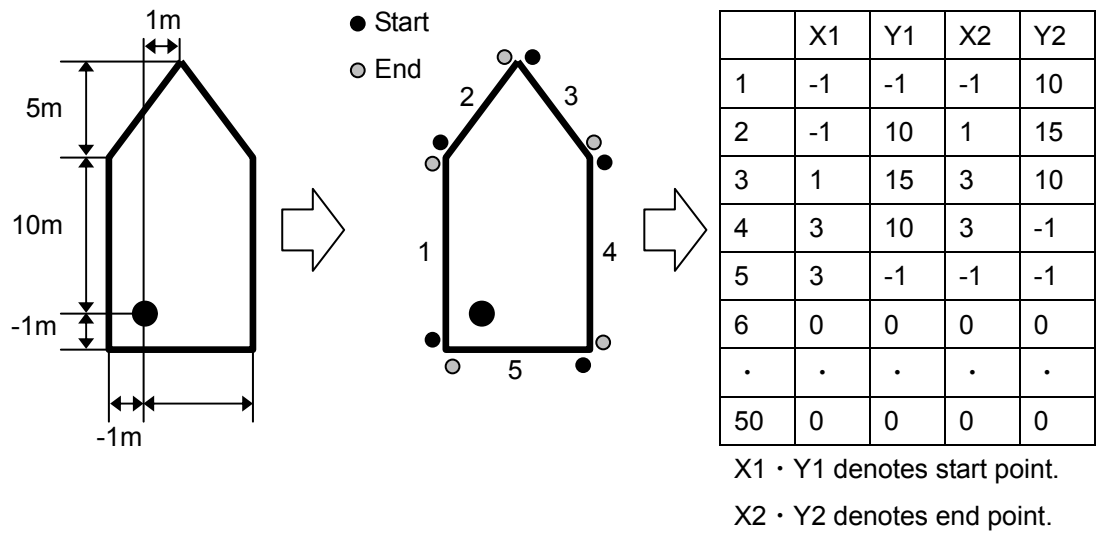
Y1 : -1000 to 1000m

X2 : -1000 to 1000m

Y2 : -1000 to 1000m

Each line is designated by Start and End point based on antenna position.

(Example)



4.3 ECHO menu

Following setting items are provided for Echo menu.

Shaded item is displayed in detailed menu.

(1)	MODE	H UP _{RM} / C UP _{RM} / C UP _{TM} / N UP _{RM} / N UP _{TM}
(2)	TRAILS*	OFF / CONTINUE / 30SEC / 1MIN / 3MIN / 6MIN / 12MIN / 24MIN / 48MIN
(3)	MODE	TRUE / REL
(4)	COLOR	BLUE / RED
(5)	SHAPE	
(6)	RANGE KEEP	OFF / ON
(7)	TIME KEEP*	OFF / ON
(8)	TRUE MOVE	COURSE / POSITION
(9)	REL MODE	HDG / TRUE
(10)	DETECT LVL	1 - 6
(11)	IR	OFF / 1 / 2 / 3 / 4 / 5
(12)	PROCESS	OFF / 1 / 2 / 3
(13)	DAY/NIGHT	DAY / NIGHT
(14)	ECHO COLOR D	WHITE / YELLOW / GREEN / MULTI
(15)	ECHO COLOR N	WHITE / YELLOW / GREEN / MULTI
(16)	BACK COLOR D	
(17)	BACK COLOR N	
(18)	ZOOM	Action
(19)	TM RESET	Action
(20)	TM RESET POSI	OPPOSITE / COURSE / CENTER
(21)	HOLD	
(22)	SECTOR	OFF / 1 / 2 START ANGLE, END ANGLE
(23)	RANGE UNIT	NM / km / sm
(24)	ROTATION MARGIN	0 - 30°
(25)	ROTATION SPEED	1 - 50
(26)	ALL PPI	OFF / ON
(27)	OFF CENT POSI	CURSOR / OPPOSITE

* When TIME KEEP is ON, selectable time of TRAILS menu are:

OFF, CONTINUE, 30s, 1min, 3min, 6min, 12min, 24min, 48min,
1hr, 2hr, 4hr, 8hr, 16hr, 24hr

(1) Select display mode

Display mode is expressed in combination of bearing display mode and motion display mode.

3 types mode [HUP], [CUP], [NUP] for bearing mode.

2 types mode [RM], [TM] for motion mode.

This device support following 5 types of mode in combination of above modes.

H UP_{RM}

C UP_{RM}

C UP_{TM}

N UP_{RM}

N UP_{TM}

- Heading signal input is required to use C UP_{RM} and N UP_{RM} mode.
- Both heading and speed signal input is required to use C UP_{TM} and N UP_{TM} mode.

1 Press [MENU] key to display menu.

Select ECHO => MODE then select from H UP_{RM}, C UP_{RM}, C UP_{TM}, N UP_{RM}, N UP_{TM}.

Display mode is displayed on upper left of the screen.

This operation can be performed by pressing [MODE] key on the panel for MDC-2500.

 Refer to “3.14 Select display mode”.

(2) Display trail

Display trail to get movement of the target.

Length of trail display is selected from CONTINUOUS, 30SEC, 1MIN, 3MIN, 6MIN, 12MIN, 24MIN and 48MIN.

No trail will be displayed when OFF is selected.

(3) Select trail display mode (relative or true)

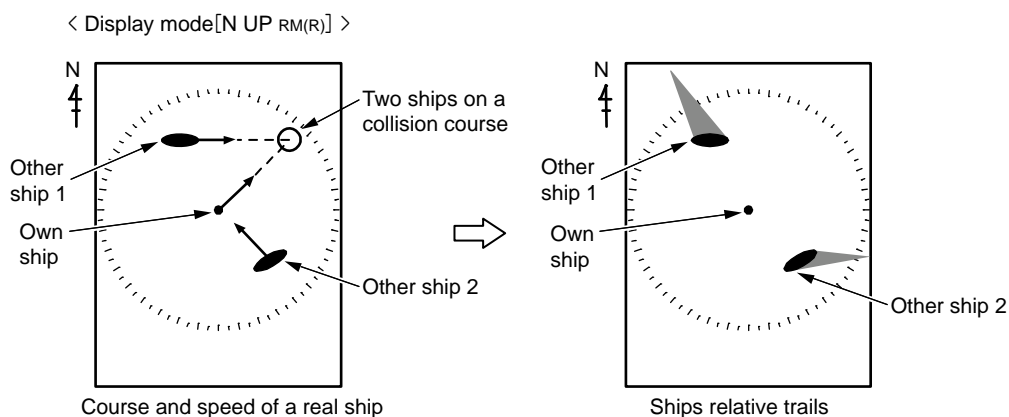
2 types of trails display mode, relative (R) and true (T) are available.

Relative trail (R)

Target trail is displayed with the result of the course and speed of the target being added those of own ship.

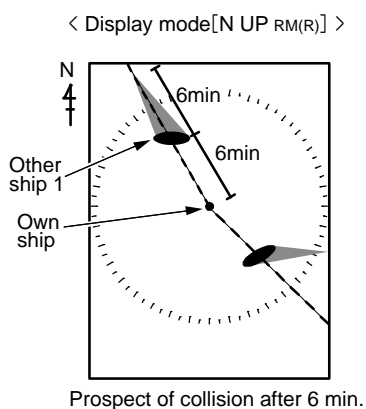
As the result, when own ship is seen overlapped on the trail extension, it means there is a risk of collision in future.

Therefore, It is effective to determine instinctively a dangerous ship.



Other ship 1 with its trail overlapped with EBL is a dangerous ship while other ship 2 is not.

Trail time is 6 min and trail length is equal to distance between own ship and other ship 1, it means that they will collide after 6 min.



True trail (T)

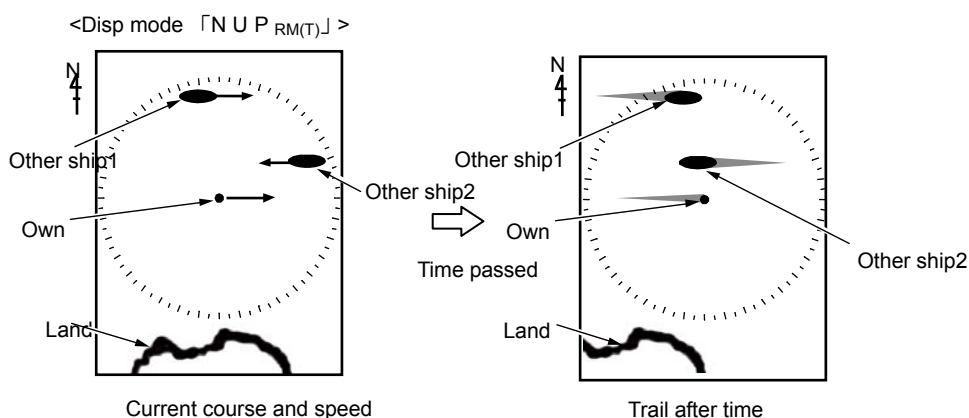
Display trail of moving target with its course and speed independently from own ship's movement.

It is used to monitor course and speed of the target.

Fixed target such as land etc. is not displayed.

Trails of moving objects, own ship, other ship 1, other ship 2 are displayed respectively in the trails moved according to each speed.

Land is not displayed as it doesn't move.






(4) Select trail color (Blue or Red)

Select trail color from blue or red.

(5) Select trail display shape

Trail display shape can be selected from following 3 types.

-  Display trail same as target size
-  Display trail with thin line
-  Display trail with taper shape as the time passed

(6) Sustain range

This function is to use to display trail of previous range.

Initial setting is 'Off' and past trail is deleted after display range is changed.

IMPORTANT: When sustain range function is "On" and pulse width is changed (long pulse width => short pulse width), screen may become hard to observe because of enlarged trail.

(7) Time keep

Factory default setting is "OFF", and trails in the past are deleted when trail time is changed.

In case of "ON", if either trail function is set "ON" or trail time is changed, the trail equivalent to the time set is displayed. Movement of the other vessels (traveling direction and speed) can be captured instantly.

In case Time keep function is set "ON", the Alarm2 detection function cannot be used in the alarm menu. Also, selectable time of TRAILS menu are OFF, CONTINUE, 30s to 24hr.

(8) Switching of base input sensor in true motion (Course or Position)

Switch calculation base of own ship movement in true trail display mode.

"Course" calculates movement distance from course and ship speed.

“Position” calculates movement distance from course and latitude/longitude.

“Position” selection is effective to obtain stable trail under rough current where error of speed sensor is large,

(9) Rel mode (Relative bearing criteria)

This is to select the signal (ship's bearing or true) as criteria to record trails, in case trail mode is used as “REL”.

Ship' bearing: Trails are recorded taking the ship's bearing as criteria.

The echo moving by own ship's turn remains as trail.

True : This is active when such a bearing sensor as gyro, GPS compass is connected, to record trails based on the true bearing from the bearing sensor.

The echo moving by own ship's turn is not recorded as trail. When compared with the ship's bearing criteria, trail image is clearer and it is easier to see the relative position with the other vessel.

(10) Trail detection level (1 to 6)

Designate trail display image strength selecting from value 1 to 6.

1 display trail even from weak image signal.

6 display trail only from strong image signal.

IMPORTANT: Lower detection level may display trail only in the position where target is not shown on the screen.

(11) Interference rejection (IR)

Other ship's radar of the same frequency band may cause interference noise on the screen. This interference effect is not uniform but in most cases spiral or radius shape. This device provides interference removal function to reduce these effects.

- Designate value is [Off, 1, 2, 3, 4, 5] and large value is for stronger removal effect.
- Too strong interference removal may mask small target.

(12) Display target stable using signal processing.

There are two types of method for screen correlation process: One is residual image process and another is averaging.

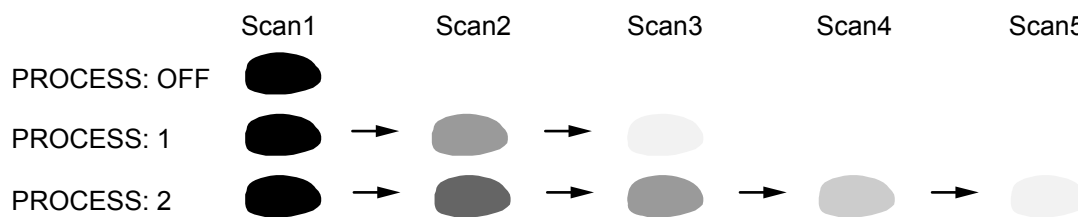
The setup values 1 and 2 represent residual image process and the set up value 3 represents averaging process.

• Residual image process:

The image that has appeared only once is not immediately deleted, but displayed with the residual image.

At the setup value 1, the image that has appeared only once is displayed after weakened in 3 steps.

At the setup value 2, the image that has appeared only once is displayed after weakened in 5 steps.



Display of residual image when an image was caught with Scan1 only

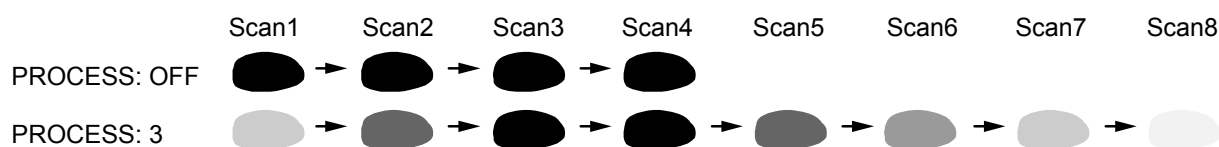
This is effective to confirm an image that appears only once per scan because the object may be hidden between the waves.

• Averaging process:

At setup value of 3, images are averaged.

When there is a stable image such as a ship among sporadic images such as sea clutter, the sea clutter is erased by averaging to leave the stable image.

Due to the averaging process, even though stable strong images appeared just after transmission, they are displayed weakly and gradually turn into strong images.



Display of averaging process in the case when an image appeared and disappeared.

* For confirmation of an image that may be hidden between the waves and the image of a fast ship that appears at a different position for each scan, the image may be displayed weaker than the actual one. Pay attention to that.

* For operation of GAIN, SEA and RAIN, it may take some time before it becomes effective. Take enough time for the operation, or operate again after [PROCESS] has been once off.

(13) Switch over Day/Night mode (Display MDC-2200 only)

Switch to pre-defined Daytime mode or Night mode display color.

Refer to "3.11 Change echo color".

Switch by [DAY/NIGHT] key in the operation panel for MDC-2500 series.

(14) Daytime Echo color selection (Change Daytime mode color)

Select Daytime mode image color.

Select from "White", "Yellow", "Green" or "Multi".

(15) Night Echo color selection (Change Night mode color)

Select Night mode image color.

Select from "White", "Yellow" "Green" or "Multi".

(16) Daytime background color selection (Change Daytime mode background color)

Select Daytime mode background color.

(17) Night background color selection (Change Night mode background color)

Select Night mode background color.

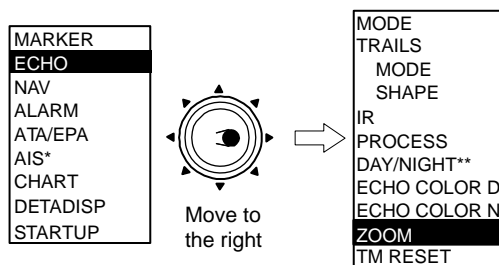
(18) Enlarge cursor position image by zooming function

Zoom function enlarge image centered by cursor position in one step lower range.

It is used to observe surrounding situation of the target at cursor position in detail.

1 Move cursor to the enlarged image position by operating cursor with [Joystick].

2 Press [MENU] key to display "Menu".
[ECHO] => [ZOOM], then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

** : DAY/NIGHT is provided for MDC-2200 series only.

(19) Reset true motion

Reset own ship position to initial value when display mode is N UP_{TM} or C UP_{TM}

Initial value is in the position set by "item (18) True motion reset position".

(20) True motion reset position

Designate reset position when display mode is N UP_{TM} or C UP_{TM}.

Select from OPPOSITE, COURSE, CENTER.

(21) Fixed Image

When select "HOLD" menu then press [ENT] key, current image will be displayed as it is for 30 seconds.

It is used to determine target in detail.

“HOLD” is displayed on the upper part of screen during the image being fixed. It turns to preparation screen after having passed 30 second.

IMPORTANT: Fixed image screen does not reflect latest circumstance. Pay attention to confirm surrounding safety when used during navigation.

(22) Sector scan

Sector scan is the function not to display designated direction image on the screen. Set bearing designation by “start bearing” and “end bearing” of sector.

Sector scan 1 is the mode not to display image of designated bearing (not suppress transmission) to avoid reflection image such as from mast or other construction objects on the screen.

Sector scan 2 is the mode to stop transmission of the designated bearing and not to display image. It is used to avoid transmission of radar wave to specific bearing.

(23) Designate range unit (NM, km, sm)

Change range unit of radar display.

This change also changes cross cursor range unit.

(24) Designate rotation angle

Image is rotated according to bearing change in H UP display mode. When rotation angle is set, the image will be rotated when the bearing changes exceeding predetermined angle. Heading display position changes according to bearing change within predetermined angle.

Setting range is up to 30 degree.

(25) Designate rotation speed

Image is rotated according to bearing change in H UP display mode.

“Rotation speed” can change image rotation speed.

Initial value is 50 in maximum speed.

Image rotates slowly when setting value is lowered.

(26) Full screen display

When full screen display turned off, the display range of radar image will remain within effective radius only. It is used to ease to see surrounding values such as numeral data around screen.

(27) Off center position

Moving location of own ship position by operating “off center” can be set toward a cross cursor position (default) or a stern direction.

4.4 NAV menu

Following items are provided in Navigation menu.

Shaded display is displayed in detailed menu

(1)	STAB	SEA / GND
(2)	MAN SET	0 - 359.9°
(3)	MAN DRIFT	0 – 100kn
(4)	VECTOR	OFF / 30SEC / 1MIN / 3MIN / 6MIN / 12MIN / 30MIN / 60MIN
(5)	TRUE/REL	REL / TRUE
(6)	NAVLIN	OFF / ON
(7)	BLOCK NO	1 - 20
(8)	BLOCK CLEAR	CANCEL / CLEAR
(9)	DETECT	OFF / ON
(10)	SETUP	A1 - A25, B1 - B25

(1) Select stabilization base (SEA/GND)

“Stabilization on SEA” means display radar image mode based on sea surface using course information from gyro (or equivalent) and speed information from speed from water sensor.

“Stabilization on GND” means display radar image mode based on ground using course and speed information from satellite navigation system. Speed in water sensor may be affected by current and stable operation may be spoiled. In this case, compensation against tide bearing and speed shall be manually applied.

Stabilization base is calculation base for true motion (TM) of radar image and ATA/AIS target bearing and speed.

(2) Set up tide bearing

Compensate effect of tidal bearing when speed over water sensor is used for “stabilization on GND”.

(3) Set up tide speed

Compensate effect of tidal speed when speed over water sensor is used for “stabilization on GND”.

(4) Set up vector display time

Set up vector display time for ATA, EPA, AIS and own ship course.

Direction of vector line denotes course and length denotes speed.

This vector means targets acquired by ATA, EPA, AIS or own ship will be reach to the location of leading edge of vector after designated time has passed.

(5) Set up vector display mode

Vector can be display by relative or true mode.
Relative mode displays target bearing and speed based on motion with respect to own ship.
True mode displays bearing and speed of the target actually moving.

Own ship vector line is not displayed in relative mode.

(6) Use navline

Navline function enables to attract attention for safety navigation with alarm display and sound when own ship crosses the course preliminarily set (by latitude/longitude input).

Navline consists of 1 block 50 points (A1 to A25, B1 to B25) and can be saved up to 20 blocks.
Select arbitrary 1 block in use. Plural blocks can not be used simultaneously.
Navline can be used as simple drawing function by its alarm function being turned off (refer to item (9) “detection”) and being line display only.

(7) Select block no. of navline

Select block no. of navline to be used.
1 to 20

(8) Delete navline by designating block no.

Delete navline data registered by latitude/longitude.
Select block no. to be deleted by using “block no.” menu.
Move cursor from “BLOCK CLEAR” => “CLEAR”, then press [ENT] key.

(9) Set up detection function

Set up function to display alarm indication and to sound alarm when own ship crossed the navline during the navline being displayed.

IMPORTANT: No alarm is displayed when this setting is tuned “OFF”.

(10) Input/edit navline data

Designate block number beforehand and then input data on latitude/longitude input screen.

SETUP : 1

LAT LON

A1 ° ' " N ° ' " E

A2

A3

LAT ▶

LON ▶

CLEAR ▶

4.5 ALARM menu

Following designation items are provided in alarm menu.

Shaded display is displayed in detailed Menu

(1)	GUARD ZONE	
(2)	LIM CPA	0.0 - 19.9NM
(3)	LIM TCPA	1.0 - 63.0MIN
(4)	ATA BUZZER	OFF / ON
(5)	AIS BUZZER	OFF / ON
(6)	ALARM 1	
(7)	DETECT	IN / OUT
(8)	DETECT LVL	1 - 7
(9)	AREA	VARIABLE / FIXED
(10)	ALARM 2 DISP	OFF / ON
(11)	BLOCK NO	1 -20
(12)	BLOCK CLEAR	CANCEL / CLEAR
(13)	DETECT	OFF / IN / OUT
(14)	DETECT LVL	1 - 7
(15)	SETUP	1 - 50

(1) Use guard zone

- Guard zone is function of setup sector alarm area. It generates alarm indication and sound when a target enters into this area and then display danger mark (red ▽ mark) on the target of the subject alarm.

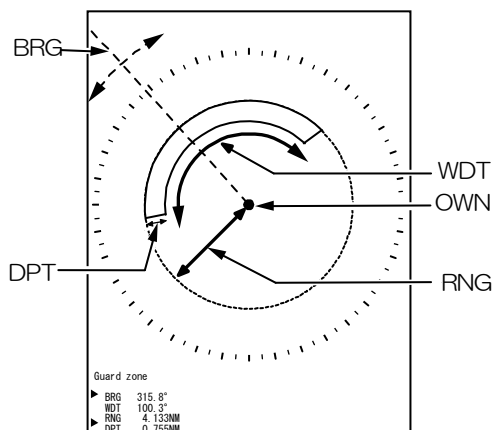
Guard zone operates by using ATA auto acquisition function and AIS information.

IMPORTANT: ATA may not be recognized depend on reflection level of target. In this case, No danger mark is indicated on the target.

IMPORTANT: Symbol is blinked in red when AIS target enters into guard zone area.

Press [MEMU] key then select [ALARM] => [GUARD ZONE] and press [ENT] key.

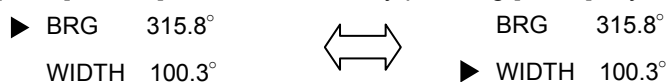
Guard zone area setup screen is displayed and the data is displayed on lower left of the screen.



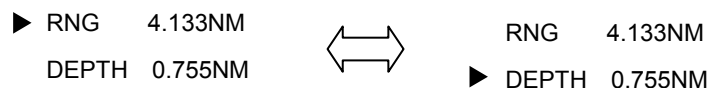
Setup [bearing] and [width] by using EBL key and EBL knob.

Setup [range] and [depth] by using VRM key and VRM knob.

[BRG] and [WIDTH] is switched over by pressing [EBL1] key or [EBL2] key.

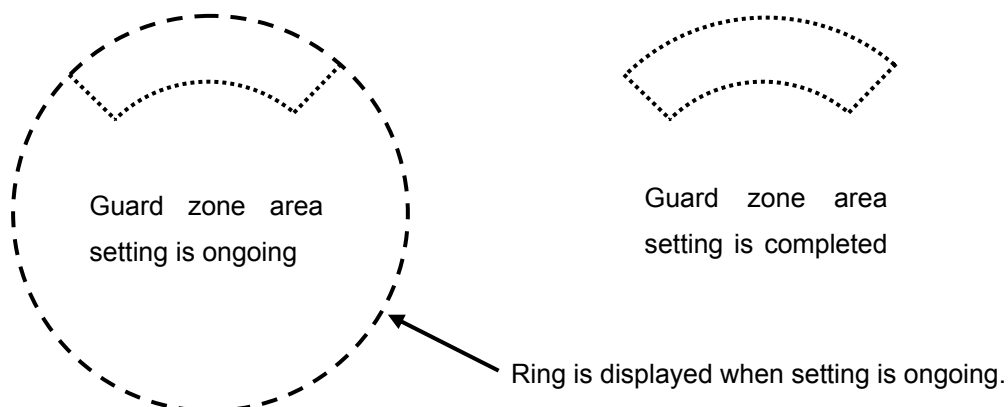


[RNG] and [DEPTH] is switched over by pressing [VRM1] key or [VRM2] key.



Select [BRG], [WIDTH], [RNG], [DEPTH] then setup area by turning EBL knob and VRM knob.

Press [ENT] key after setup then setting is completed.



Removal of guard zone function

Press [MENU] key to display "Menu".

Select [ALARM] => [GUARD ZONE], then press [ENT] key.

(2) Setup CPA

Setting value : 0.0 to 19.9NM

- This item is to set minimum distance of “Closest point of approach” from own ship.
- Alarm indication is displayed and alarm sound is generated when the target to be distinguished its course and its speed by EPA/ATA/AIS undergone the setup value of both CPA/TCPA.

(3) Setup TCPA

Setting value: 1 to 63 min

- This item is to setup minimum time of “Time to closest point of approach” from own ship.
- Alarm indication is displayed and alarm sound is generated when the target to be distinguished its course and its speed by EPA/ATA/AIS undergone the setup value of both CPA/TCPA.

(4) Setup ATA buzzer sound

Setup ATA buzzer [OFF] when alarm sound of operating ATA (alarm by CPA/TCPA, alarm of lost target) is not used.

(5) Setup AIS buzzer sound

Setup AIS buzzer [OFF] when alarm sound of operating AIS is not used.

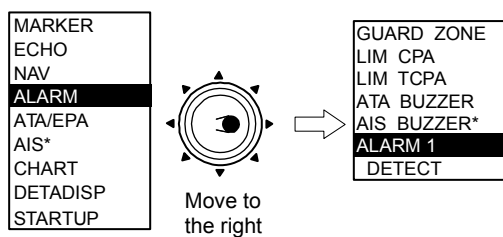
(6) Use Alarm 1

- Alarm 1 displays alarm indication and generates alarm sound when target enters into or leave from the sector (fun) shaped alarm area being designated by range and bearing from own ship.

Operation method

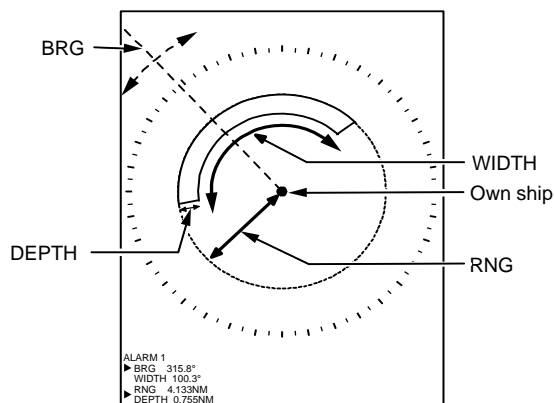
1 Press [Menu] key to display [MENU].

Select [ALARM] => [ALARM1 AREA] then press {ENT} key.



* : Displayed at installation of AIS unit (optional).

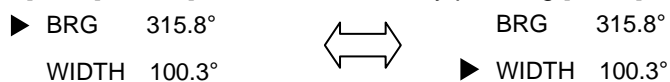
- 2** Alarm1 area setting screen will be displayed.



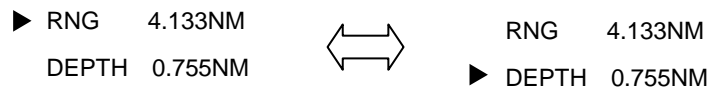
Setup [bearing] and [width] by using EBL key and EBL knob.

Setup [range] and [depth] by using VRM key and VRM knob.

- 3** [BRG] and [WIDTH] are switched over by pressing [EBL1] key or [EBL2] key.

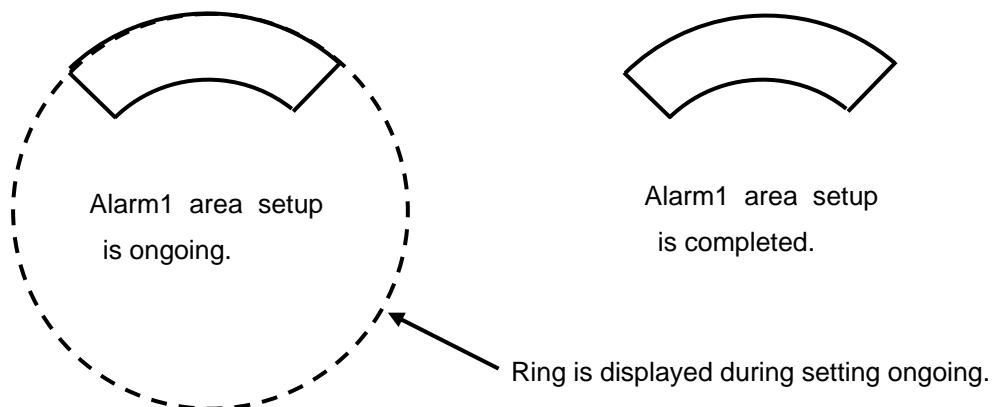


- 4** [RNG] and [DEPTH] are switched over by pressing [VRM1] key or [VRM2] key.



Select [BRG], [WDT], [RNG], [DPT] then setup area by using EBL knob and VRM knob.

- 5** Press [ENT] key after setup to complete setting.



To delete Alarm1 function

- 6** Press [MENU] key to display "Menu".

Select [ALARM] => [ALARM1 AREA] then press [ENT] key.

(7) Setup Alarm 1 detection mode

Setting value: IN, OUT

- “IN” displays alarm indication and generates alarm sound when target enters into alarm setting area.
- “OUT” displays alarm indication and generates alarm sound when target leaves from alarm setting area.

(8) Setup Alarm 1 detection level

Set up signal level to detect target within setup alarm area.

Setting value is 1 to 7.

Small setting value responds to weak signal.

Large setting value responds only to strong signal level.

Too small setting value will respond alarm even to noise.

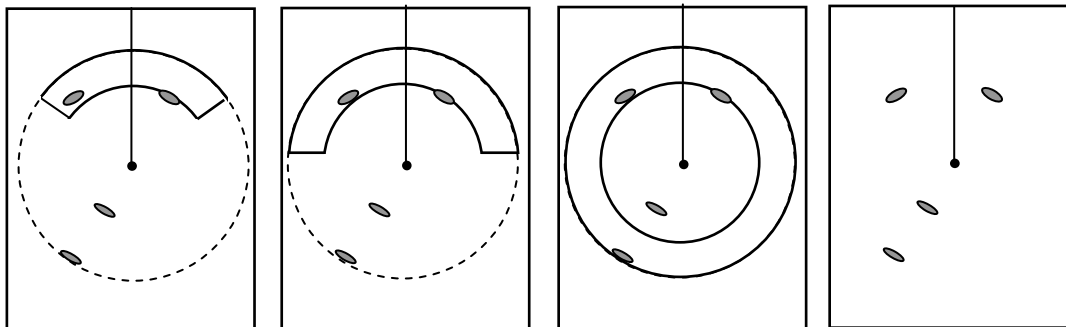
Pay attention that too high setting value will not respond to small target.

(9) Setup Alarm 1 area setting method

Alarm1 area setting method. (select “VARIABLE” or “FIXED”)

Initial value is “variable” and refer to item (6) “Use alarm1” for setting operation.

When “fixed” is set and also [ALARM1 AREA] is assigned to F (Function) key, alarm area is switched over to Area1 (90°) => Area2(180°) => Area3(360°) by pressing F (Function) key.



(10) Use Alarm 2

Alarm 2 setups alarm area of arbitrary shape (up to 50 points by latitude/longitude input) and displays alarm indication and generates alarm sound when target enters into or leaves from the alarm setup area.

Heading signal and latitude/longitude signal are required to use alarm2 function.

1 Press [MENU] key to display “Menu”.

Select [ALARM] => [ALARM2 DISP] => [ON] then press [ENT] key.

(11) Select Alarm 2 block number

Select Alarm2 block number to use.

Block numbers up to 20 types (1 to 20) can be selected.

(12) Delete registered data by designating block number

Delete Alarm2 data registered with latitude/longitude.

Select Alarm2 block number to delete by using item (11) "Select Alarm2 block number".

Move cursor [BLOCK CLEAR] => [CLEAR] then press [ENT] key.

(13) Select Alarm 2 detection method

Setting value : OFF, IN, OUT

- “IN” displays alarm indication and generates alarm sound when target enters into alarm setup area.
- “OUT” displays alarm indication and generates alarm sound when target leaves from alarm setup area
- Off does not detect alarm.

This enables to use Alarm2 function to draw a simple figure by displaying the area of Alarm2 only.

(14) Setup Alarm 2 detection level

This item is to setup signal level for target detection in the alarm setup area.

Setting value is 1 to 7.

Small setting value responds to weak signal.

Large setting value responds to strong signal only.

Too low setting value responds to alarm even by noise.

Pay attention that too high value may not respond to weak target.

(15) Input/edit Alarm 2 data

SETUP : 1

LAT

LON

DIVIDE

1

°

.

N

°

.

E

LAT ▶

2

LON ▶

3

DIVIDE ▶

CLEAR ▶

LAT: Input latitude data.

LON: Input longitude data.

DIVIDE: OFF, ON

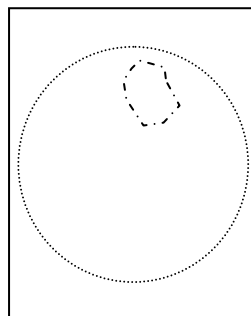
Up to 50 points can be input for 1 block. When divide is ON, input data is divided and displays independently from the data to follow.

Area setting of Alarm2 requires to input at least 3 points. When dividing function is put on in every 3 points, maximum 16 areas can be input and displayed within one block.

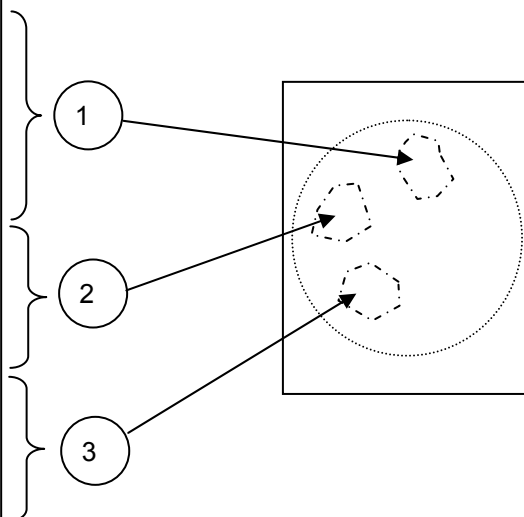
CLEAR : Clear Lat/Lon/Div data previously input.

Refer to item (12) “Delete registered data by designating block number” to delete all data in the block.

LATITUDE/LONGITUDE INPUT : 1			
	LATITUDE	LONGITUDE	DIVIDE
1	35° 00.000N	135° 00.000E	OFF
2	35° 01.000N	135° 01.000E	OFF
3	35° 02.000N	135° 02.000E	OFF
4	35° 03.000N	135° 03.000E	OFF
5	35° 04.000N	135° 04.000E	OFF
6	35° 05.000N	135° 05.000E	OFF
7	35° 06.000N	135° 06.000E	OFF
8	35° 07.000N	135° 07.000E	OFF
9	35° 08.000N	135° 08.000E	OFF
10	35° 09.000N	135° 09.000E	OFF



LATITUDE/LONGITUDE INPUT : 1			
	LATITUDE	LONGITUDE	DIVIDE
1	35° 00.000N	135° 00.000E	OFF
2	35° 01.000N	135° 01.000E	OFF
3	35° 02.000N	135° 02.000E	OFF
4	35° 03.000N	135° 03.000E	OFF
5	35° 04.000N	135° 04.000E	OFF
6	35° 05.000N	135° 05.000E	OFF
7	35° 06.000N	135° 06.000E	OFF
8	35° 07.000N	135° 07.000E	OFF
9	35° 08.000N	135° 08.000E	OFF
10	35° 09.000N	135° 09.000E	ON
11	35° 20.000N	135° 20.000E	OFF
12	35° 21.000N	135° 21.000E	OFF
13	35° 22.000N	135° 22.000E	OFF
14	35° 23.000N	135° 23.000E	OFF
15	35° 24.000N	135° 24.000E	OFF
16	35° 25.000N	135° 25.000E	OFF
17	35° 26.000N	135° 26.000E	ON
18	35° 37.000N	135° 37.000E	OFF
19	35° 38.000N	135° 38.000E	OFF
20	35° 39.000N	135° 39.000E	OFF
21	35° 40.000N	135° 40.000E	OFF
22	35° 41.000N	135° 41.000E	OFF
23	35° 42.000N	135° 42.000E	OFF
24	35° 43.000N	135° 43.000E	OFF



Delete alarm sound

Press [OFF] key to delete sound while alarm is sounding.

4.6 ATA/EPA menu

Following items provided for ATA/EPA menu.

Refer to “3.15 Use ATA/EPA” for detail.

Shaded display is displayed in detailed Menu.

(1)	ATA/EPA TYPE	ATA / EPA
(2)	ACQ	
(3)	DELETE	
(4)	ALL DELETE	
(5)	MAN ACQ NO	0 - 50
(6)	AUTO DETECT	
(7)	TARGET ID	OFF / ON
(8)	ID SIZE	SMALL / MID / LARGE
(9)	TARGET SELECT	0 - 49
(10)	EPA UPDATE	
(11)	DATA STYLE	B/R / L/L

(1) Select ATA function or EPA function

Select ATA function or EPA function.


ATA (Automatic Tracking Aid) function enables to acquire manually (select target one by one) or automatically (pre-defined area) up to 50 targets and to track automatically.

EPA (Electronic Plotting Aid) function enables to calculate course and speed of the target based on the position data of 2 points which is once manually acquired and manually acquired again after at least 30 second passed. The targets up to 50 can be acquired.

(2) Manual target acquisition

Move cross cursor to point target to be acquired by using [Joystick].

Select acquisition menu then press [ENT] key. Symbol is displayed on cursor position.

“ □ mark is displayed just after acquisition then changes to ○ mark after about 30 seconds. Target number is displayed near the target.

Manual acquisition can be performed easily by using [ACQ] key for (MDC-2500) or [Function] key for (MDC-2200) on the operation panel. Refer to “3.15 Use ATA/EPA”.

(3) Select acquired target and delete it

Move cross cursor to point target to delete by using [Joystick].

Or, select target number to delete by using item (9) “Target selection”.

Select delete menu and press [ENT] key.

Delete operation can be performed by [OFF] key and [ACQ] key operation in addition to this procedure.

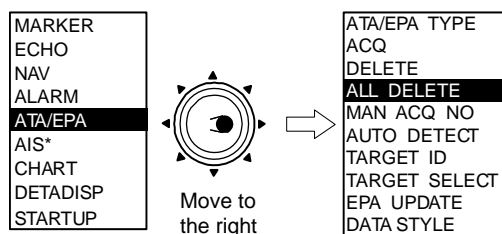
Refer to “3.15 Use ATA/EPA”.

(4) Delete all acquired targets

Delete all acquired targets.

Press [MENU] key to display “Menu”.

Select [ATA/EPA] ⇒ [ALL DELETE] then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

(5) Setting method for acquiring number manually

Set up number of the targets to acquire manually.

Initial value is 10 targets. When changes number to be acquired manually, auto acquiring number is also changed at the same time.

(50 – manual acquisition number = auto acquisition number)

Note: Auto acquisition function is not available when manual acquisition number is set to 50.

(6) Auto acquisition

Set up auto acquisition area.

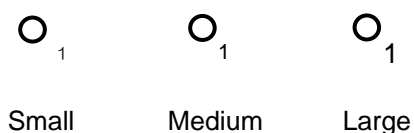
Refer to “3.15 Use ATA/EPA”.

(7) Set up target ID display

This function enables to display target ID (number) in the acquired ATA symbol.

(8) ID size

Set up size of target ID (number).



(9) Select target

This function determine target number to perform [Information display • Delete operation].

(10) EPA Update

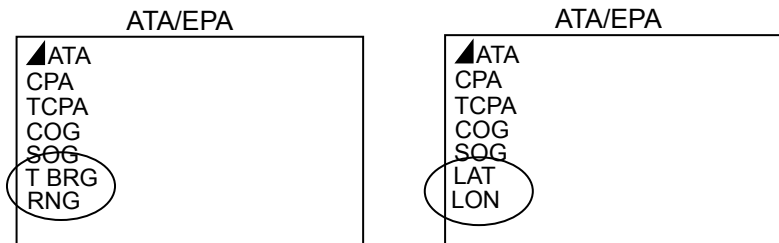
Refer to “3.15 Use ATA/EPA”.

(11) Data display format

Set up ATA/EPA information display content to be displayed at lower part of the screen.

Select "RNG/BRG" or "LAT/LON" format.

IMPORTANT: Refer to "4.9 DATADISP menu" for data display method.



4.7 AIS menu (Optional AIS unit required)

Following items are provided in AIS menu.

Shaded display is displayed in detailed Menu.

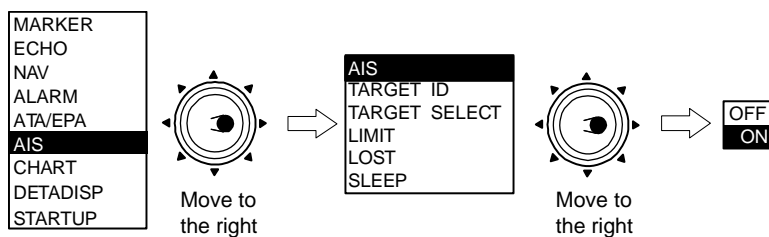
(1)	AIS	OFF / ON
(2)	TARGET ID	OFF / NUMBER / NAME / BOTH
(3)	TARGET SELECT	100 - 299
(4)	LIMIT	1.0 - 64.0NM
(5)	LOST	OFF / ON
(6)	SLEEP	OFF / A / B / BOTH
(7)	CLASS B	OFF / ON
(8)	ATON	OFF / ON
(9)	SART	OFF / ON
(10)	BASE	OFF / ON
(11)	AUTO ACQ RNG	0.0 - 20.0NM

- AIS function is used with installation of optional AIS unit.
- Note: AIS menu is not displayed without AIS unit.
- VDM sentence signal from AIS device is required to display AIS information.
- Other ship symbol/other ship ID up to 200 can be displayed.

(1) Activate AIS display

- 1 Press [MENU] key to display "Menu."

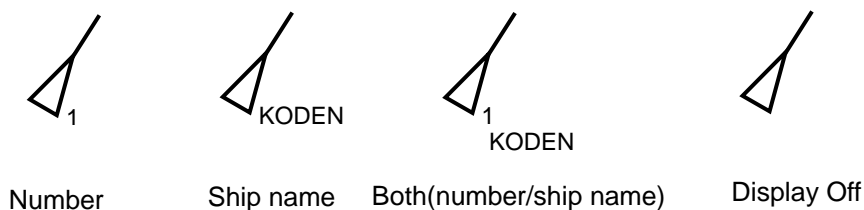
Proceed to [AIS] => [AIS] then select [ON] and press [ENT] key.



(2) Set up target ID display

Target ID can be displayed in AIS symbol on the screen.

Select target ID display from Number, ship name, both (Number/ship name), Display OFF.



(3) Select target

Switch Active <=> Sleep in AIS information display.

This item is to select target when displaying detailed AIS information in data display area at lower screen.

Select target then press [ENT] key, then data is switched over.

The same operation can be performed on the screen by moving cursor to the target to be displayed then press [ENT] key.

- Change from sleep display to active display: Point cursor on target to change then press [ENT] key.
- Change from active display to sleep display : Point cursor on target to change then press [ENT] key while pressing [OFF] key.

(4) Setup detection area (Display area setup)

Setup area to display AIS information.

Setup by range of 1.0NM to 64.0NM area from own ship.

- Extension of detection area setting in crowded place may exceed 200 of maximum displayable number. Pay attention, if such case happened, "Overflow" message is displayed and alarm is sounded and display of further other ships becomes unavailable.

(5) Setup lost target display

Setup lost alarm display for lost target.

ON: Display lost alarm and sound alarm.

OFF: Lost alarm is not displayed.

(6) Setup sleep ship display

Setup sleep symbol display.

OFF: Sleep ship is not displayed.

A : Display Class A sleep ship.

B : Display Class B sleep ship.

BOTH: Display both Class A and Class B sleep ship.

(7) Setup class B target display

Setup class B target symbol display.

ON: Display class B target symbol.

OFF: Class B target symbol is not displayed.

(8) Setup ATON target display

Setup ATON target symbol display.

ON: Display ATON target symbol.

OFF: ATON target symbol is not displayed.

(9) Setup SART target display

Setup SAET target symbol display.

ON: Display SART target symbol.

OFF: SART target symbol is not displayed.

(10) Setup BASE target display

Setup BASE target symbol display.

ON: Display BASE target symbol.




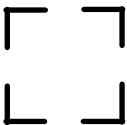


OFF: BASE target symbol is not displayed.

(11) Auto acquisition ring

Setup the area to switch sleep target to active automatically.

Type and meaning of AIS symbols

AIS display symbol overlapped to other ship based on obtained information.

Normal symbol	Meaning
	SLEEP Display of the ship not selected for information display.
 	ACTIVE Display of the ship selected for information display.
	Display of the ship selected for detail information display. Detail information is indicated on the lower part of the display.
Alarm symbol	Meaning
 Blink in 0.5 sec. interval	It is displayed when it has under run the specified CAP or TCPA value. It is drawn with a thick red line and the alarm sounds.
 Blink in 0.5 sec. interval	Display of out of track (lost) ship. When the sleep ship becomes lost ship, no alarm sounds and it disappears from the display after 1min.

4.8 CHART menu

Following items are provided in Chart menu.

Shaded display is displayed in detailed Menu.

(1)	CHART	OFF / ON
(2)	PAST CRS	
	SETUP	1 - 30 (OFF / DISP / OWN / ATA / AIS)
(3)	PLOT INT	OFF / CONTINUE / 15SEC / 30SEC / 1MIN / 3MIN / 6MIN / 12MIN
(4)	CLEAR	1 - 30 (CANCEL / CLEAR)
(5)	WPT/ROUTE	OFF / ON
(6)	MARK	OFF / ON
(7)	BLOCK NO	1 - 20
(8)	BLOCK CLEAR	CANCEL / CLEAR
(9)	LINE	OFF / ON
(10)	SHAPE	(Select mark shape from 18 types)
(11)	OWN	(Input mark on own ship position)
(12)	CURSOR	(Input mark on cursor position)
(13)	SETUP	(Input mark by latitude/longitude)
(14)	DISP ALL	OFF / ON
(15)	CHART SELECT	JAPAN / GLOBAL
(16)	CHART DISP SET	(Chart setting: color, place name, lighthouse, buoy, etc.)
(17)	NAV ALIGN MODE	OFF / MANUAL / SERIAL
(18)	NAV ALIGN LAT	-1.000 - 1.000
(19)	NAV ALIGN LON	-1.000 - 1.000
(20)	WPT/ROUTE ID	OFF / ON
(21)	WPT FLAG	OFF / ON
(22)	COAST LINE/GPS BUOY	Coast line/GPS buoy
(23)	COAST LINE	(Enable to produce coast line by itself)
(24)	GPS BUOY	(Enable to display GPS buoys)

Note: (1) CHART, (16) CHART DISP SET is not displayed without Chart card.

(1) Display/hide chart.

Setup Chart display on the screen.

ON: Chart is displayed.

OFF: Chart is disappeared

Note: When Chart card is inserted during operation, it may not be recognized. Power off this device once then start up again.

Note: About C-MAP chart

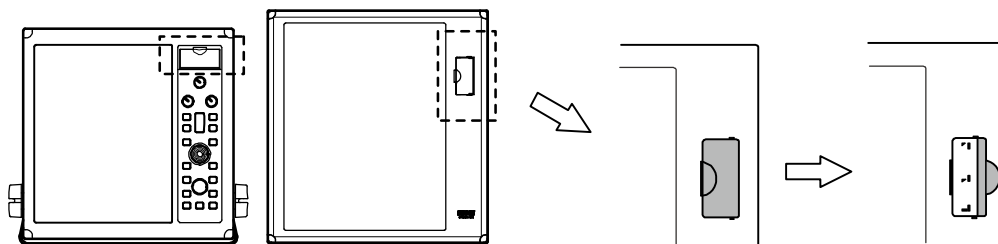
When a C-MAP chart card for a special area is used, there are cases where no chart could be displayed at some positions or at some ranges.

This is because that there is no most appropriate chart information and not because of failure of the radar. In those cases, please try to change the range to get the chart.

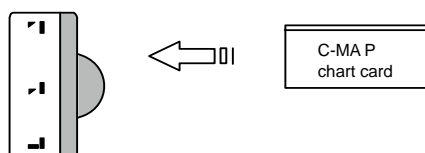
Insert method of C-MAP chart card

- 1 Open the lid located at right side of the radar screen and confirm loading slot.

Two loading slots are located. (No functional differences between two.).



- 2 Pay attention that card orientation and then insert card to the end.



- 3 Slide downward by pressing card, then it will be fixed. (for MDC-2200)

Slide to the right by pressing card, then it will be fixed. (for MDC-2500)

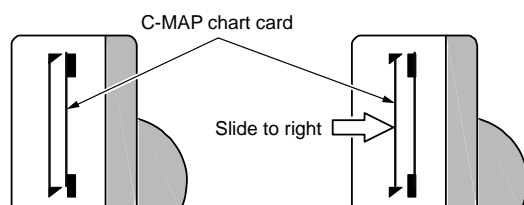
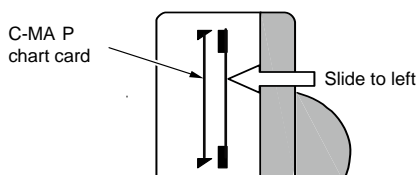


Chart card removal

Slide card upward by pressing, then card can be removed easily. (for MDC-2200)

Slide card to the left by pressing, then card can be removed easily. (for MDC-2500)



(2) Setup own ship track, ATA target track, and AIS target track

This device provides functions to record own ship track, ATA target track, and AIS target track on the display.

Memory up to 30 tracks is provided and each max memory is 1000.

- These tracks are shown on the displayed during recording.
- These tracks are displayed even exceeding maximum memory points in case of same range (without changing the range).

Set up each memory number (1 to 30) for using track record function.

OFF: No memory and no display

DISP: Display only

OWN: Own ship track memory and display

ATA: ATA target track memory and display

AIS: AIS target track memory and display

Trail display color and shape are as follows.

BLUE	PINK	RED	GREEN	ORANGE	BROWN	
1	6	11	16	21	26	—————
2	7	12	17	22	27
3	8	13	18	23	28	- - - - -
4	9	14	19	24	29	— — — —
5	10	15	20	25	30

How to set own ship track

- 1 Select [CHART] => [PAST CRS 1 to 30] => [OWN], then press [ENT] key.
- 2 To discontinue memory, [OFF] or [DISP] is selected.

How to set ATA target track

- 1 Select [CHART] => [PAST CRS 1 to 30] => [ATA], then press [ENT] key.
- 2 Move cross cursor using [Joystick] to lay on the target to be memorized, and press [ENT] key.
- 3 To discontinue memory, move cross cursor using [Joystick] to lay on the target, and press [ENT] key. Or [OFF] or [DISP] is selected.

How to AIS target track

- 1** Select [CHART] => [PAST CRS 1 to 30] => [AIS], then press [ENT] key.
- 2** Move cross cursor using [Joystick] to lay on the target to be memorized, and press [ENT] key.
- 3** To discontinue memory, move cross cursor using [Joystick] to lay on the target, and press [ENT] key. Also [OFF] or [DISP] is selected.

(3) Setup track memory interval

Set up track memory interval (time).

Setting value: OFF, Continuous, 15sec, 30sec, 1min, 3min, 6min and 12min

When interval is shorten, detailed track can be memorized but memorable distance becomes short.

When interval is set longer, long distance can be memorized but track display becomes rough.

(4) Delete track

Delete memorized track.

Select track number to delete by the menu of track display number and then execute deletion.

(5) Setup Way point/route

When waypoint/route information is provided by GPS or by plotter, it can be displayed on the radar screen as waypoint/route.

Waypoint is displayed by ○ mark in the screen.

Input sentence necessary for way point display is "RMB" or "BWC".

Input sentence necessary for route display is "RTE" or "WPL".

ID of Way point/route can be displayed. Refer to (20) Display Waypoint/Route ID.

Flag mark can be displayed on Way point. Refer to (21) Display flag mark on waypoint.

(6) Display mark

This Device is provided as a mark input function 20 block and each block is capable to accept input of 50 points. Set to "ON" to display mark on the radar screen.

Note: Latitude/longitude and heading signal are required to use mark function.

(7) Select block number for mark display

Select block number of mark display. (1 to 20)

Mark of selected block number is displayed, and additionally input mark data is also registered to this selected block number.

(8) Delete mark data of specified block number

Delete unnecessary mark data.

Select block number by "(7) block number" then execute deletion.

(9) Display line from own ship location to mark.

This is to set up to display line from own ship location to specified mark.

Setup line to "ON", then line is displayed by following procedures.

Input mark on waypoint and display line enabling the shortest navigation.

Line display method

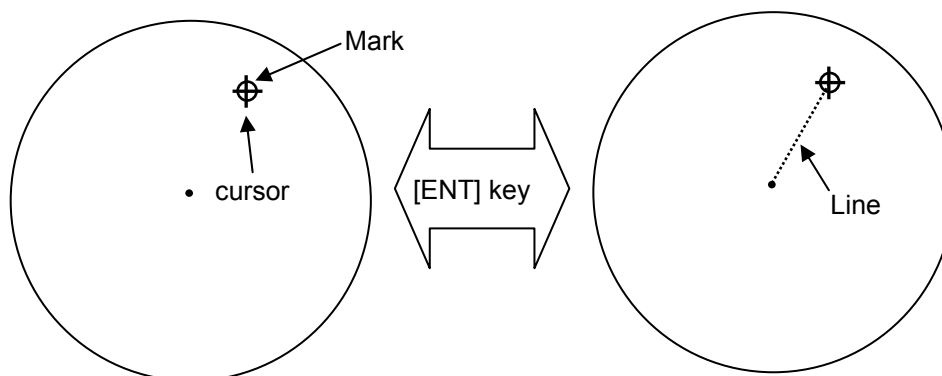
Move cursor to mark on the screen

Press [ENT] key

Line deletion method

Move cursor to the mark of line to delete.

Press [ENT] key.

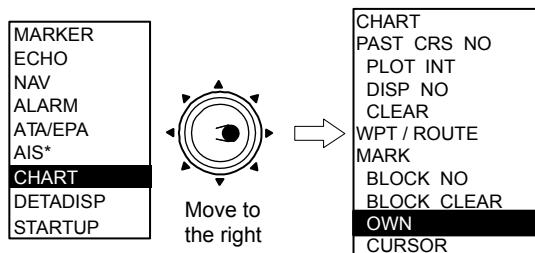
**(10) Select display mark shape**

Select input mark shape (out of 18 types).

When mark shape is changed after inputting mark, it can be performed by using (13) latitude/longitude input Menu.

(11) Input mark (own ship position)

Proceed [CHART] => [OWN] then press [ENT] key.



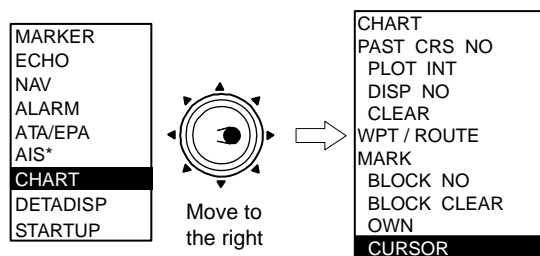
* : Displayed at installation of AIS unit (optional).

This operation becomes easier when "MARK OWN" is assigned to F key.

(12) Mark input/delete (cursor position)

Move cursor to input position by using [Joystick].

[MENU] key => [CHART] => [CURSOR] then press [ENT] key.



* : Displayed at installation of AIS unit (optional).

Operation becomes easier by assigning "MARK CURSOR" to F key.

(Delete mark)

- 1 Move cursor onto mark to be deleted.
- 2 Press [Menu] key then select [CHART] => [CURSOR] and press [ENT] key by keeping [OFF] key pressed.

In case of [MARK OWN], [MARK CURSOR] is assigned to F (Function) key.

- 1 Move cursor onto mark to be deleted.
- 2 Press [F] key by keeping [OFF] key pressed.

(13) Input/edit mark (latitude/longitude input)

Input mark by latitude/longitude.

With this menu mark data already registered can be edited.

- Change shape
- Change latitude data
- Change longitude data
- Delete data

(14) All marks display

All marks can be displayed regardless of the block number.

OFF: Mark designated with block number is displayed.

ON: All mark is displayed.

(15) Select chart

Select Global chart or Japan chart (C-MAP).

This device automatically selects overseas chart in English mode and Japan Chart in Japanese mode.

(16) Detail chart display setting

Change chart color (Daytime mode/Night mode)

Display place name

Display lighthouse

Display buoy

Display fish haven/wreck

Display traffic routes

Display caution area

Display fishery

Display cable

are to be set.

(17) Accommodate radar image and chart display (position compensation)

As this device is set for geographic coordinate system WGS84, latitude/longitude data from the device based on other system being used may cause inconsistency between radar image and chart display.

Position compensation function is used to accommodate chart display to radar image.

Manual and serial signal (position compensation information: DTM sentence) methods are available for position compensation.

When manual method is selected. Input correction value by using (18) Correct latitude, (19) Correct longitude.

(18) Correct latitude

Correct latitude of chart display. Correction range is -1.000° to 1.000° .

(19) Correct longitude

Correct longitude of chart display. Correction range is -1.000° to 1.000° .

Position compensation setting becomes easier when display mode is N UP.

(20) Display Waypoint/Route ID

ID can be displayed to waypoint/route in the radar screen.

ID is input by navigation device as waypoint/route data.

(21) Display flag mark on waypoint

As waypoint is displayed by  mark, it can be displayed also by flag mark to ease to be distinguished.

(22) Select COAST LINE/GPS BUOY

This radar is provided with functions to produce coast line by itself and to display GPS buoys.

The both of them cannot be used simultaneously and either one of them shall be used.

With this item, the function to use shall be selected.

(23) Using of COAST LINE

When COAST LINE has been selected in (22), this can be used.

A coast line is a line consisting of 50 points (called as 1 block) and total 20 lines can be produced. For each point, latitude and longitude shall be input.

(24) Using of GPS buoys

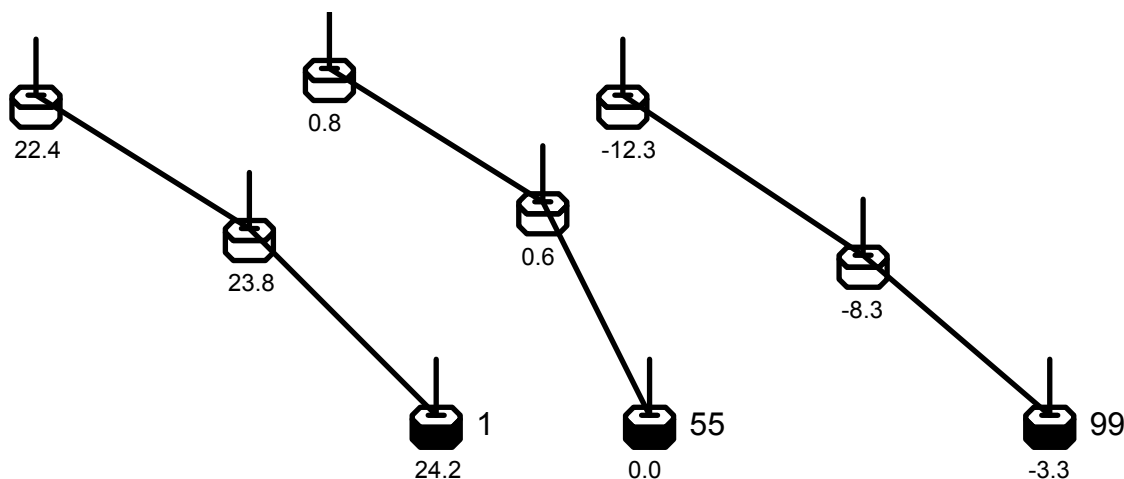
When GPS BUOY has been selected in (22), this can be used.

GPS buoys can be used when GPS buoy transmitter/receiver made by TAIYO MUSEN is connected to the display and buoy information sentences (BLV) is received.

Buoy IDs can be recorded up to 10 kinds.

Time, position and water temperature up to 100 points can be recorded per 1 ID. In the latest data, in addition to time, position and water temperature, course, speed and battery voltage can be recorded.

Examples of display:



Buoys with same ID will be displayed linked with straight lines. Under each buoy symbol, water temperature can be indicated.

The latest data will be indicated with marked-out symbols, and ID can be also indicated at the right hand side of the symbol as shown in the above examples.

1	NUM DISP	ON
2	WAT TEMP DISP	ON
3	BLOCK NUMBER	1
4	BLOCK CLEAR	>
5	BLOCK DATA	>
6	TIME	11/25 16:33:40
	NUMBER	1
	LAT	39°13.600N
	LON	139°46.000E
	CRS	0.0°
	SPD	5kn
	WAT TEMP	-9.8°C
	BATT VOL	12.3V

1. NUM DISP

This is the function to display Buoy IDs at the right sides of the latest data buoy symbols

2. WAT TEMP DISP

This is the function to display water temperature under the buoy symbols.

3. BLOCK NUMBER

This is the function to select block numbers. 1 ID buoy data can be recorded in 1 block.

The following 4 ~ 6 will be applied to the blocks selected in above 3.

4. BLOCK CLEAR

This is the function to deleted buoy data recorded in blocks.

5. BLOCK DATA

This is the function to confirm buoy data in blocks in a list of data.

6. LATEST BUOY DATA

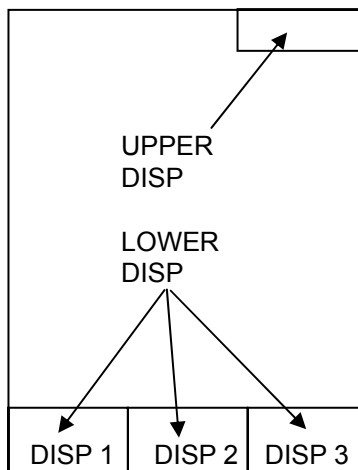
This is the function to display the latest buoy data.

4.9 DATADISP menu

Following designation items are provided in DATADISP menu.

Shaded display is displayed in detail Menu.

- | | |
|-----|-----------------|
| (1) | UPPER DISP |
| (2) | LOWER DISP BACK |
| (3) | DISP 1 |
| (4) | DISP 2 |
| (5) | DISP 3 |
| (6) | PROTECT CANCEL |
| | (OR) PROTECT |



This device enables to display various data on the upper screen or lower screen (3 positions) as shown in the figure.

DATADISP menu is used to select display data.

DATADISP menu is also utilized to display detailed menu.

(1) Upper display setting

Select from following items. No display when OFF is selected.

- Stabilization base (SEA or GND)
- COG/SOG (Own ship information, COG & SOG)
- Latitude/longitude (Own ship information, lat/lon)
- LOP (Own ship information LOP)
- Tidal bearing/speed (Own ship information, Set & Drift)
- Water depth, water temperature (Own ship information, Depth & Temperature)
- Waypoint latitude/longitude (Waypoint information, latitude & longitude)
- Waypoint Bearing/distance (Waypoint information. Bearing & Distance)
- Antenna location/Inter switch
- Time (Date & Time)
- Vector (Vector time display)
- OFF

(2) Lower display area background color setting

Setup background color of lower screen display area.


When the setting is OFF, data is displayed on radar image and radar observation area is expanded.

When the setting is ON, display data becomes to read easily as background is masked.

(3) Setup DISP1 display item

Select lower screen, left display items.

Setting value : OFF, OWN1, OWN2, WPT, ATA/EPA, AIS, NAV, AIS DETAIL1, AIS DETAIL2

OWN 1	OWN 2	WPT
▲OWN LAT LON COG SOG SET DRIFT	▲OWN DEPTH W TEMP TD TD ΔLAT ΔLOT	▲WPT ID LAT LON R BRG RNG XTE
ATA/EPA	AIS	NAV
▲ATA CPA TCPA COG SOG T BRG RNG	▲AIS MMSI NAME CPA TCPA COG SOG	▲NAV T VECT Limit CPA TCPA AIS DATUM REF LOCAL
AIS DETAIL 1	AIS DETAIL 2	
▲AIS T BRG RNG LAT LON HDG ROT	▲AIS DEST ETA DIM 	

(4) Setup DISP2 display item

Select lower screen, middle display items.

Setup item is the same as the one displayed left.

(5) Setup DISP3 display item

Select lower screen, right display item.

Setup item is the same as the one displayed left.

(6) Protect cancel

To display detailed Menu, Select protect cancel then press [ENT] key.

Refer to item 4.1 “How to see and use Menu” for detail.

4.10 STARTUP menu

Following setting items are provided in STARTUP menu.

(1)	TUNE SELECT	AUTO / MANUAL
(2)	TUNE AUTO	0 - 255 (Setting for tuning method "Auto")
(3)	TUNE MANUAL	0.0 - 100.0 (Setting for tuning method "Manual")
(4)	BRG ADJ	-180° - 180°
(5)	TX DELAY ADJ	0 - 255
(6)	STC CURVE1	0 - 15
(7)	MBS	0 - 30
(8)	F1 KEY SET	F1 function key setting
(9)	F2 KEY SET	F2 function key setting
(10)	F3 KEY SET	F3 function key setting (MDC-2500 only)
(11)	RAIN KEY SET	Setting to Rain key
(12)	SEA KEY SET	Setting to Sea key
(13)	GAIN KEY SET	Setting to Gain key

Refer to Installation manual for detailed operation of STARTUP menu.

Also refer to "3.16 Use F (Function key)" of this document for function key setting.

(1) Tuning method

This item is to select tuning method (Auto or Manual).

Normally Auto is selected. Manual is selected when optimum image cannot be obtained by auto mode.

(2) Auto tune setting

Execute fine tuning in case "Auto" selection of item (1) tuning method is selected.

(3) Manual tuning setting

Execute fine tuning in case "Manual" selection of item (1) tuning method is selected.

(4) Bearing setting

Adjust calibration of actual image bearing to align to bearing on the radar screen.

(5) Range adjustment

Adjust calibration of actual target range to align to range on the radar screen.

(6) STC curve

Sea surface reflection is varied depending on antenna height and sea state. Set up STC characteristics

(curve) to obtain optimum sea surface reflection removal effect.

- Bigger the value obtains higher the effect in short range but the effective range becomes shorter.
- Oppositely, smaller the value obtains longer the effective range but the effect in short range becomes weak.

(7) Main Bang Suppression

Suppress surrounding image of nearby own ship due to own pulse to make image easier to observe.

Note: Too high setting value may delete image of nearby own ship.

(8)(9)(10) F key setting

Set up function assignment to each function key.

(11) RAIN key setting

Set up function assignment to Rain reflection key.

(12) SEA key setting

Set up function assignment to Sea reflection key.

(13) GAIN key setting

Set up function assignment to Gain key.

4.11 I/O menu

Following setup items are provided in I/O menu.

(1)	HDG	HDG (OFF / ON), Input setting, Manual setting, CORR, KGC-1 SET
(2)	SPD	SPD (OFF / ON), Input setting, Manual setting
(3)	COG/SOG	AUTO, VTG, RMC, RMA
(4)	LAT/LON	Input setting, Manual setting
(5)	GND STAB MODE	AUTO / VDR / VBW / COG/SOG / MAN
(6)	OUTPUT (J4, J5)	Output data setting
(7)	BAUDRATE	J4, J5, J6 baud rate setting
(8)	INPUT	Input sentence setting

Input/output menu sets up NMEA data exchange setting for navigation devices.

Refer to Installation manual for detail operation of Input/output menu.

(1) Heading bearing

Set up input of heading bearing.

Set to "Off" when heading signal input is not input to use.

(2) Ship speed

Set up input of ship speed.

Set to "Off" when ship speed signal input is not input to use.

(3) COG/SOG

Set up input of signal for course on ground and speed on ground.

(4) Latitude/longitude

Set up input of latitude/longitude signals of own ship position.

(5) Ground stabilization setting

Select input signal for ground stabilization base.

(6) Output (J4, J5)

This is used to specify transmit interval of each sentence from J4 and J5 connector.

It is required when transmitting interval is specified for connecting device.

Setting items: GLL, HDT, RSD, OSD, TLL*, TTM, VDR, VHW, VTG

Setting value: 0.0 to 10.0 s

Transmission is suppressed when value 0 second is specified.

(* [TLL] is activated when [TLL OUT] described in the next is set to ATA.)

TLL OUT

This is used to select the output data of TLL format.

Setting value : ATA, MARK, TARGET

ATA : The target acquisition data of ATA is output by TLL format. (Output interval depends on the setting value at (6))

MARK : When the function key assigned to "EVENT CURSOR" or "EVENT OWN" is pressed, the mark positioning data is output by TLL format.

TARGET : When the function key assigned to "TLL OUT" is pressed, the cursor positioning data is output by TLL format.

(7) Baud rate

Set up baud rate of each input/output port according to the connected sensor.

Baud rate is selected from 4800, 9600, 19200 and 38400.

(8) Input

Confirmation of input signal of serial input connector (J4, J5, J6) and selection of input port.

	J4	J5	J6	
BWC	—	—	—	ALL
DBT	—	—	—	ALL
DPT	—	—	—	ALL
DTM	—	—	—	ALL
GGA	○	—	○	J6
GLC	—	—	—	ALL
GLL	—	—	—	ALL
GNS	—	—	—	ALL
HDG	—	—	—	ALL
HDM	—	—	—	ALL
HDT	—	—	○	ALL
MTW	—	—	—	ALL
RMA	—	—	—	ALL
RMB	—	—	—	ALL
RMC	—	—	—	ALL
RTE	—	—	—	ALL
THS	—	—	—	ALL
VBW	—	—	—	ALL
VDR	—	—	—	ALL
VHW	—	—	—	ALL
VTG	—	—	○	ALL
WPL	—	—	—	ALL
XTE	—	—	—	ALL
ZDA	—	—	—	ALL

— denotes no signal.

○ denotes signal input is exist.

ALL denotes every input port signal is valid.

GGA signal denotes signal input from port J4 and J6.

It also denotes GGA signal is used only from J6 port.

4.12 SYSTEM menu

Following items are provided in SYSTEM menu.

(1)	LANG	ENGLISH / JAPANESE
(2)	BUZZER	OFF / ON
(3)	BUZZER FREQ	1 - 7
(4)	KEY CLICK	OFF / ON
(5)	EXT BUZZER	OFF / CONTINUE / INTERVAL

System menu is used to perform basic setting of this device.

Refer to Installation manual for detailed operation.

(1) LANG

Switch display language (English or Japanese).

(2) Buzzer sound

Set up On/Off of alarm sound.

No buzzer sound even when alarm is detected when set to Off.

(3) Buzzer sound frequency.

Change buzzer tone by changing frequency.

Setup value is 1 to 7, 1 is lowest tone and 7 is highest tone.

(4) Key click

Key click sound in panel operation can be set to off.

(5) External buzzer

External buzzer signal can be output from J1 connector on the back panel.

Output signal is in voltage level. (equal to source voltage to this device). Output capacity is up to 1A.

Signal voltage is output continuously when set to the continuous.

Signal voltage is output intermittently when set to frequency.

4.13 PRESET menu

Following items are provided in PRESET menu.

(1)	GAIN MAN	0 - 255
(2)	STC MAN MAX	0 - 255
(3)	STC MAN MIN	0 - 100
(4)	STC CURVE1	0 - 15
(5)	FTC MAN	1 - 3
(6)	MBS	0 - 30
(7)	ATA TGT LVL	0 - 30
(8)	ATA PERFORMANCE	0 / 1 / 2 / 3 / 4 / 5 / 6 / 7
(9)	VIDEO MODE	0 / 1 / 2 / 3 / 4

Preset menu is used to adjust radar image (Gain, STC, ATA target level and Video mode (gradation of image)).

Refer to Installation manual for detailed operation of preset menu.

(1) Gain manual

Set up maximum value of Gain adjustment by gain knob.

Large setting value enables to obtain optimum image position by slight handling of Gain knob.

Small setting value enables to extend handling range of Gain knob for easier adjustment.

Note: Too small setting value may decrease maximum gain.

(2) Manual STC maximum

Set up maximum value of STC adjustment range by STC knob.

Large setting value expands STC effect range by STC knob operation.

Small setting value narrows STC effect range by STC knob operation.

Normally this value shall be set to make STC effective range about 6NM according to STC curve setting.

(3) Manual STC minimum

Set up pre-STC value.

Note: Too large setting value makes STC effect excessively even when STC knob is "0" position and may result that small target disappears.

(4) STC curve

Effect of sea surface reflection varies according to the antenna height.

STC curve shall be set according to installation status of antenna.

(5) FTC manual selection

Not in use. Do not change setting value. Initial value is "1".

(6) Main Bang Suppression

Suppress surrounding image of nearby own ship due to own pulse to make image easier to observe.

Note: Too high setting value may delete image of nearby own ship.

(7) Target level

Set up video signal level of ATA.

(8) ATA Performance (Details in development)

This is to select the optimum tracking characteristics (calculation process) depending on the purpose of usage, to make the best of the ATA performance.

Select the most suitable setting to the behavior of own ship or target.

Note: This is currently not in use as ATA software is in development.

(9) Video mode

This is a function to change the relation between the strength of signal of target echo and their display gradation.

At [VIDEO 0], the difference of signals strength between dark images and bright images becomes larger. As the numerical figure becomes larger as [VIDEO 1], [VIDEO 2] and [VIDEO 3], the difference in signal strength becomes smaller.

At [VIDEO 4], the difference of signal strength becomes gradually smaller in the range at close to 5 NM and becomes constant at 5 NM or higher. When the difference of signal strength is large, it will be easy to display clutter at darker level and targets at brighter level.

When the difference of signal strength is small, images becomes sharper.

However, signal strength from small ships and buoys is weak, and the difference between clutter and them is not large enough.

Therefore, it is necessary to display the clutter not to get in the way and not to overlook small ships and course buoys.

4.14 CONTRAST menu

Following items are provided in Contrast menu, for both day mode and night mode.

(1)	ALL	Change brilliance of total screen.
(2)	ECHO	Change radar echo brilliance.
(3)	TRAILS	Change trails brilliance.
(4)	BACK	Change radar background color brilliance.
(5)	CHART	Change chart brilliance.
(6)	CURSOR	Change cursor brilliance.
(7)	MARKER 1	Change heading, stern line, EBL, VRM, PI brilliance.
(8)	MARKER 2	Change Range ring brilliance.
(9)	ATA/EPA	Change ATA/EPA/AIS symbol brilliance.
(10)	DATA	Change brilliance of character data in the screen.
(11)	MENU	Change Menu brilliance.

Contrast menu enables to set up brilliance of items independently on screen such as radar image, menu, marker and data.

Refer to Installation manual for detail operation.

4.15 BITE menu

Following items are provided in Bite menu.

This menu is displayed only in detailed menu.

- | | |
|------|----------------|
| (1) | ALARM TEST |
| (2) | ATA TEST |
| (3) | TOTAL HOURS |
| (4) | TX HOURS |
| (5) | PANEL TEST |
| (6) | MONITOR |
| (7) | MONITOR NO SEL |
| (8) | DIAGNOSES ATA |
| (9) | DIAGNOSES AIS |
| (10) | VERSION |

Bite menu is used to diagnose this device.

Refer to Installation manual for detailed operation of Bite menu.

(1) Alarm test

This item is used to test alarm function.

Pseudo alarm is displayed and alarm sound is beeped for 10 second when “On” is set and then restored after 10 seconds.

(2) ATA test

This is a test to confirm ATA function.

2 types of × mark appears when test is started.

Large × mark means that test is currently ongoing.

Pseudo echo will be appeared under the small × mark. Press [ACQ] key to start acquisition operation.

When acquisition operation becomes stable, the confirmation of ATA normal operation is completed.

(3) Total operating hours

This displays total operation time of display unit.

It is reset to “0 hours” for Initialization.

(4) Transmitting hours

This displays total transmitting time of this device.

This gives rough idea of time to change Magnetron.

It is reset to “0 hours” for Initialization.

(5) Panel test

Execute operational test of operating panel.

Operating panel test screen will be displayed when being selected.

It enables to confirm knob handling and key function.

Test screen will disappear by pressing [MENU] key. (Test end)

(6) Monitor

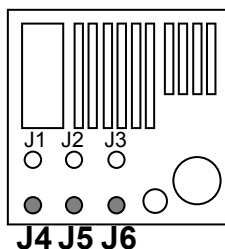
This function displays data from serial input port designated by Item (7) monitor number. Data input shall be confirmed to use.

Press [ENT] key to stop data to quite in the middle.

(7) Monitor No. selection

Select input port for input confirmation specified in Item (6) monitor.

Refer to figure below for back panel connector number.

**(8) ATA diagnose**

This item is used to diagnose ATA board operation status.

- marked item means normal operation.
- × marked item means malfunction.

(9) AIS diagnose

This item is used to confirm AIS board operation status.

- marked item means normal operation.
- × marked item means malfunction.

(10) Version

This item is used to display version of software used in this device.

- RADAR : Device main software
- PANEL : Operation panel software
- ATA : ATA board software
- AIS : AIS board software
- MAP : Chart display software of main unit

Each item respectively shows the version of software.

4.16 ANTENNA menu

Antenna menu displays status of antenna unit. (cannot operate)

This menu is displayed only in detailed menu.

	ANTENNA	
	STATUS	
(1)	HIGH VOLTAGE	XXX
(2)	MAG CURRENT	YYY
(3)	MAG HEATER	ZZZ
(4)	TUNE VOLTAGE	AAA
(5)	ANTENNA UNIT TYPE	
(6)	AD: Communication status to Antenna	

(1) High voltage

This is a monitor for transmitting high voltage.

(2) MAG current

This is a monitor for the magnetron current.

(3) MAG heater voltage

This is a monitor for the magnetron heater voltage.

(4) Tune voltage

This is a monitor for the receiver tuning circuit voltage.

(5) Antenna unit type

Display names of the connected antenna units.

(6) Antenna unit communication status

This is a monitor to show communication status to antenna unit. There is no problems when item (1) to item (5) above mentioned were diagnosed normal.

4.17 OPTION menu

The following items are provided in Option menu.

This menu is displayed only in detailed menu.

- | | |
|-----|--------------|
| (1) | INTER SWITCH |
| (2) | ANT POSI |
| (3) | ECHO OFFSET |
| (4) | HDG OFFSET |
| (5) | MOTER SPEED |
| (6) | DISP INFO |
| (7) | FERRY MODE |
| (8) | LENGTH UNIT |

Inter-switch connection, antennal high speed rotation etc, are set by this option menu.

Refer to Installation manual for detail operation of option menu.

(1) Inter-switch

Set up inter-switch function mode in use.

(2) Antennal location designation

Designate antennal location in inter-switch mode.

(3) Echo offset

Offset slave image position in inter-switch mode.

(4) Heading offset

Offset slave heading bearing in inter-switch mode.

(5) Antenna high speed rotation

Set up when antenna high speed rotation is used.

- | |
|--------|
| OFF |
| 0.0625 |
| 0.125 |
| 0.25 |
| 0.5 |
| 0.75 |
| 1 |
| 1.5 |
| 2 |
| 3 |
| 4 |
| 6 |
| 8 |
| 12 |
| 16 |
| 24 |
| 32 |
| 36 |
| 48 |
| 72 |
| 96 |
| 144 |

← High speed rotation is not available in OFF.

Select high speed rotation range then press [ENT] key.

For example, when 6NM is selected and press [ENT] key,

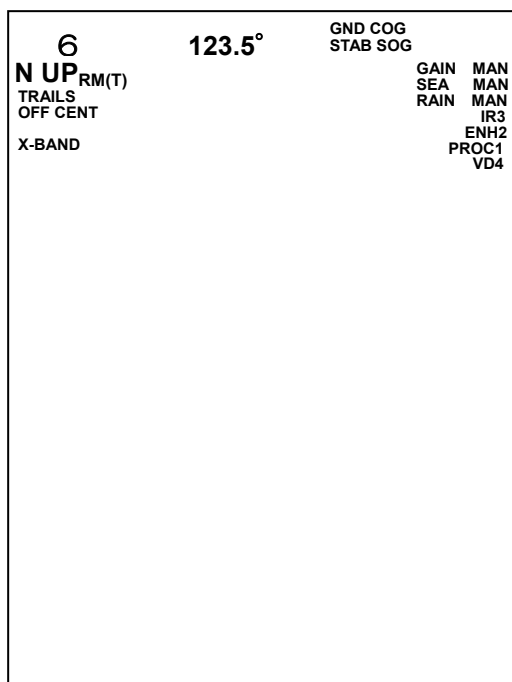
High speed rotation in 0.0625 to 6NM range

Low speed (normal) rotation in 8NM or up.

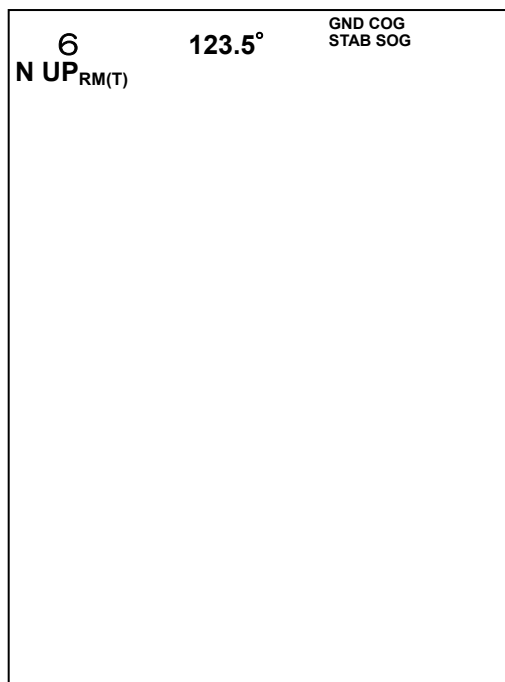
(6) Display information

This item is used to hide display of information shown in the surroundings on the screen (X-band, Gain manual, Sea reflection, manual, Rain reflection, manual, Interference removal, Enhance image, Video). Image display area is expanded to improve easy viewing.

Hidden information is displayed for 10 seconds after setting alternation of interference removal, enhance image and video.



Information ON



Information OFF

(7) Ferry mode

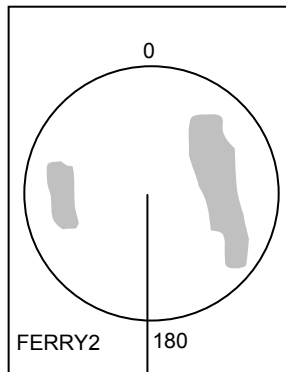
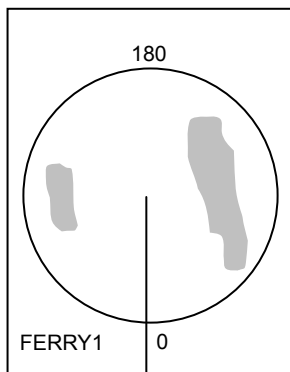
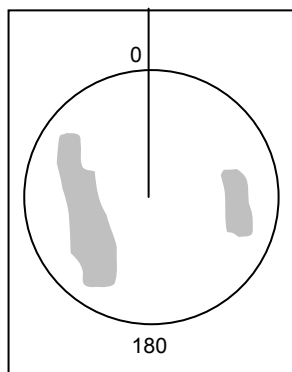
Selection: OFF, 1, 2

This is the function used on such a vessel as ferry on a river (of which ship's bearing is reversed to/from the destination).

Ferry mode is activated in H UP, and "FERRY1" or "FERRY2" is displayed on the left lower corner of the screen when in use.

FERRY1: Image, heading line and bearing scale are displayed all in reverse.

FERRY2: Image and heading line are displayed in reverse, but bearing is displayed normal.



(8) Length unit

The length unit of the following items can be changed from m to ft.

- Guard line
- Own ship's outline
- Barge (in river mode)
- Depth (upper, lower)
- AIS dimension

4.18 INITIAL menu

Following designation items are provided in Initial menu.

This menu is displayed only in detailed menu during pre-heating or standby screen.

This menu cannot be operated during transmission.

- | | |
|------|--------------|
| (1) | SETUP LOAD |
| (2) | SETUP SAVE |
| (3) | EXT LOAD |
| (4) | EXT SAVE |
| (5) | SYS PRG LOAD |
| (6) | ATA PRG LOAD |
| (7) | AIS PRG LOAD |
| (8) | MARK LOAD |
| (9) | MARK SAVE |
| (10) | PAST LOAD |
| (11) | PAST SAVE |
| (12) | PRESET LOAD |

(1) Readout of setup items

IMPORTANT: Setting values must be saved beforehand.

Readout setting value previously saved in item (2) Setup save operation.

It is used to recover setting values in case that radar operation becomes abnormal and unrecoverable etc.

Saved setting value is read and set by proceeding [SETUP LOAD] => [EXEC] => [ENT] key operation.

Note: Saved setting values of previous version software can not be readout after change of device software version.

(2) Setup save

This operation enables to save setting values when initial setup operation is complete or setting alternation or data input (mark, navline, alarm2 data etc.) are performed.

When operation of main unit becomes abnormal and the setup values can not be recovered, setup values can be recovered by using "Readout of setup items" shown in above item (1).

Current setup value is saved by [SETUP SAVE] => [EXEC] => Press [ENT] key.

(3) External load

This command is for maintenance by dedicated tool in PC.

This is to load the preset values saved in PC by (4) External save into radar.

This brings the values back to the setting last time it was saved.

(4) External save

This command is for maintenance by dedicated tool in PC.

This is to save the setting values into PC.

The saved setting can be loaded by (3) External load.

(5) System program load

This command is for maintenance by dedicated tool in PC.

This is to update the software program on the main unit.

(6) ATA program load

This command is for maintenance by dedicated tool in PC.

This is to update the ATA software program.

(7) AIS program load

Not available.

(8) Mark load

This command is for maintenance by dedicated tool in PC.

This is to load the data related to mark (NAVLINE, ALARM2, MARK, COAST LINE) saved in PC by (9) Mark save.

(9) Mark save

This command is for maintenance by dedicated tool in PC.

This is to save the data related to mark (NAVLINE, ALARM2, MARK, COAST LINE) in PC.

Loading of the saved data can be done by (8) Mark load.

(10) Past load

This command is for maintenance by dedicated tool in PC.

This is to load the data related to trail (OWN, ATA, AIS) saved in PC by (11) Past save.

(11) Past save

This command is for maintenance by dedicated tool in PC.

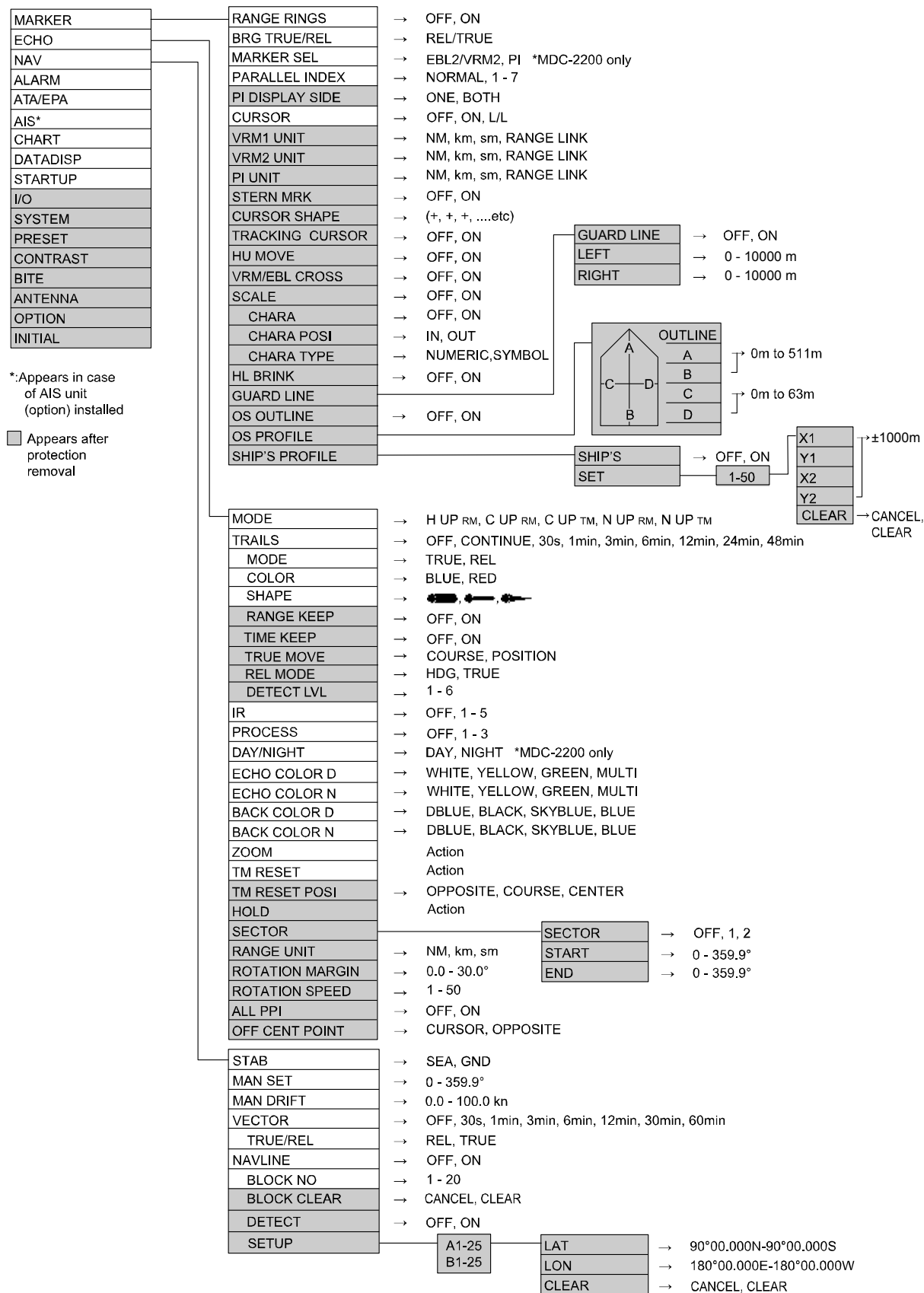
This is to save the data related to trail (OWN, ATA, AIS trail) in PC.

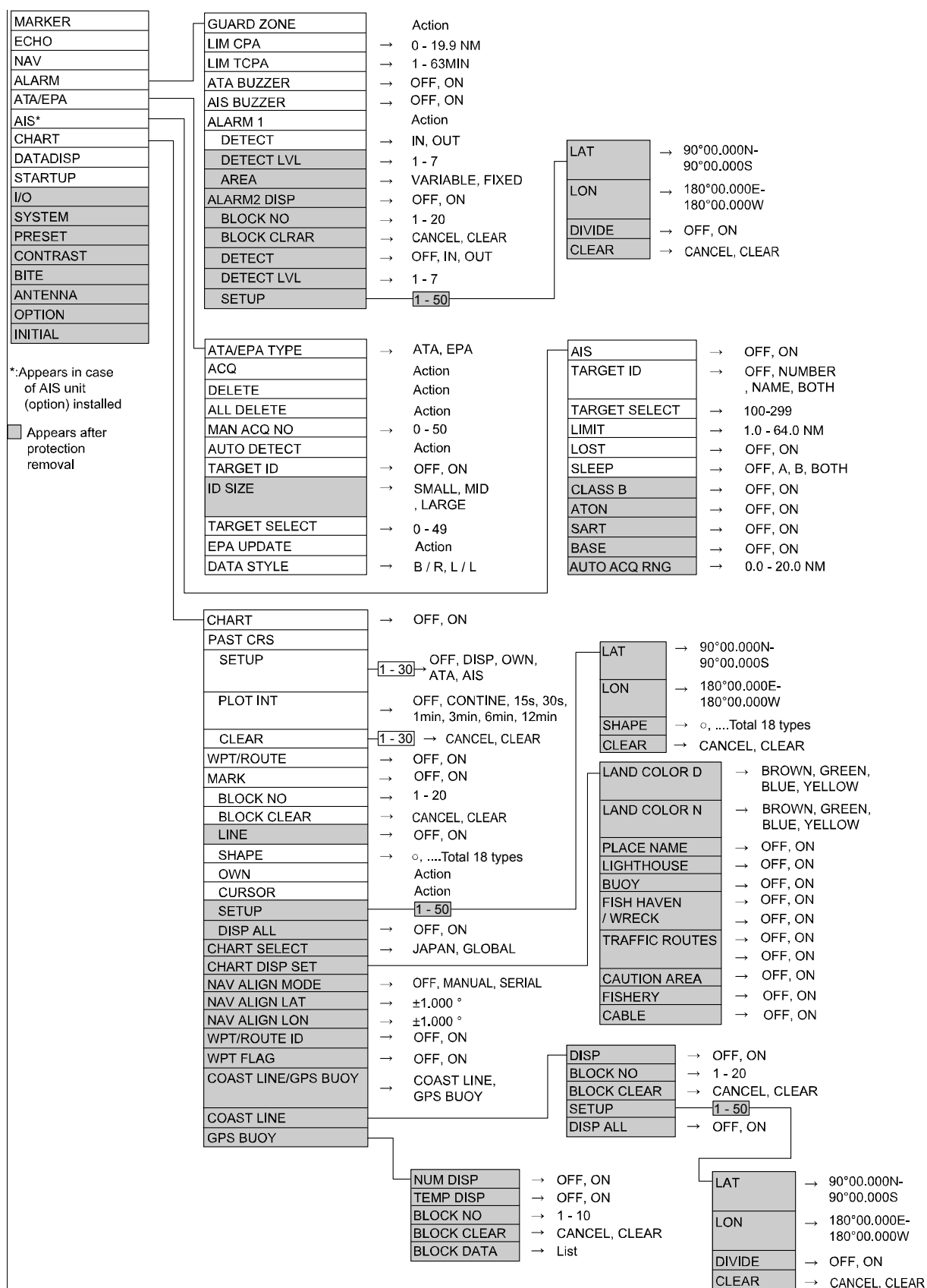
The saved data can be loaded by (10) Past load.

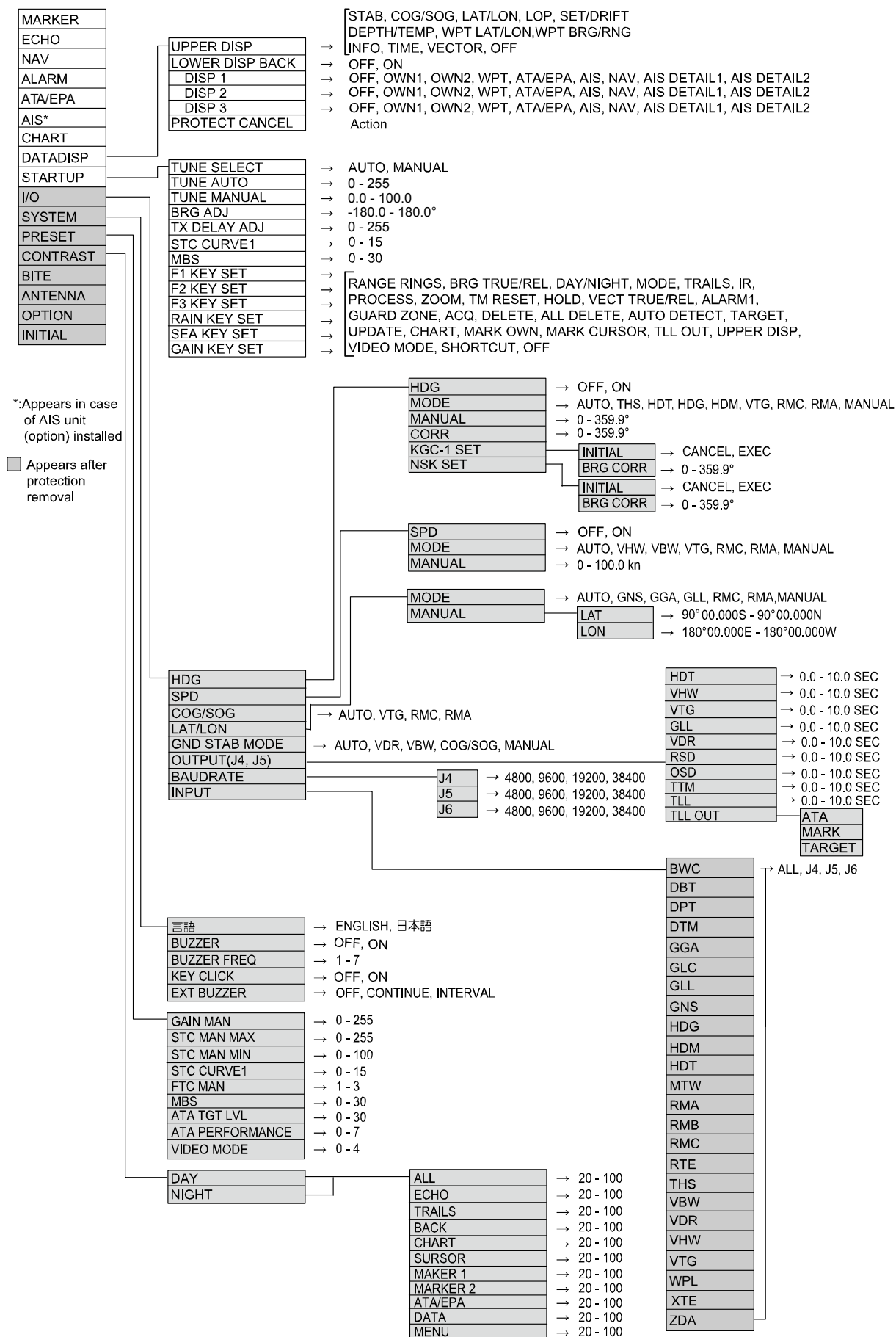
(12) Preset load

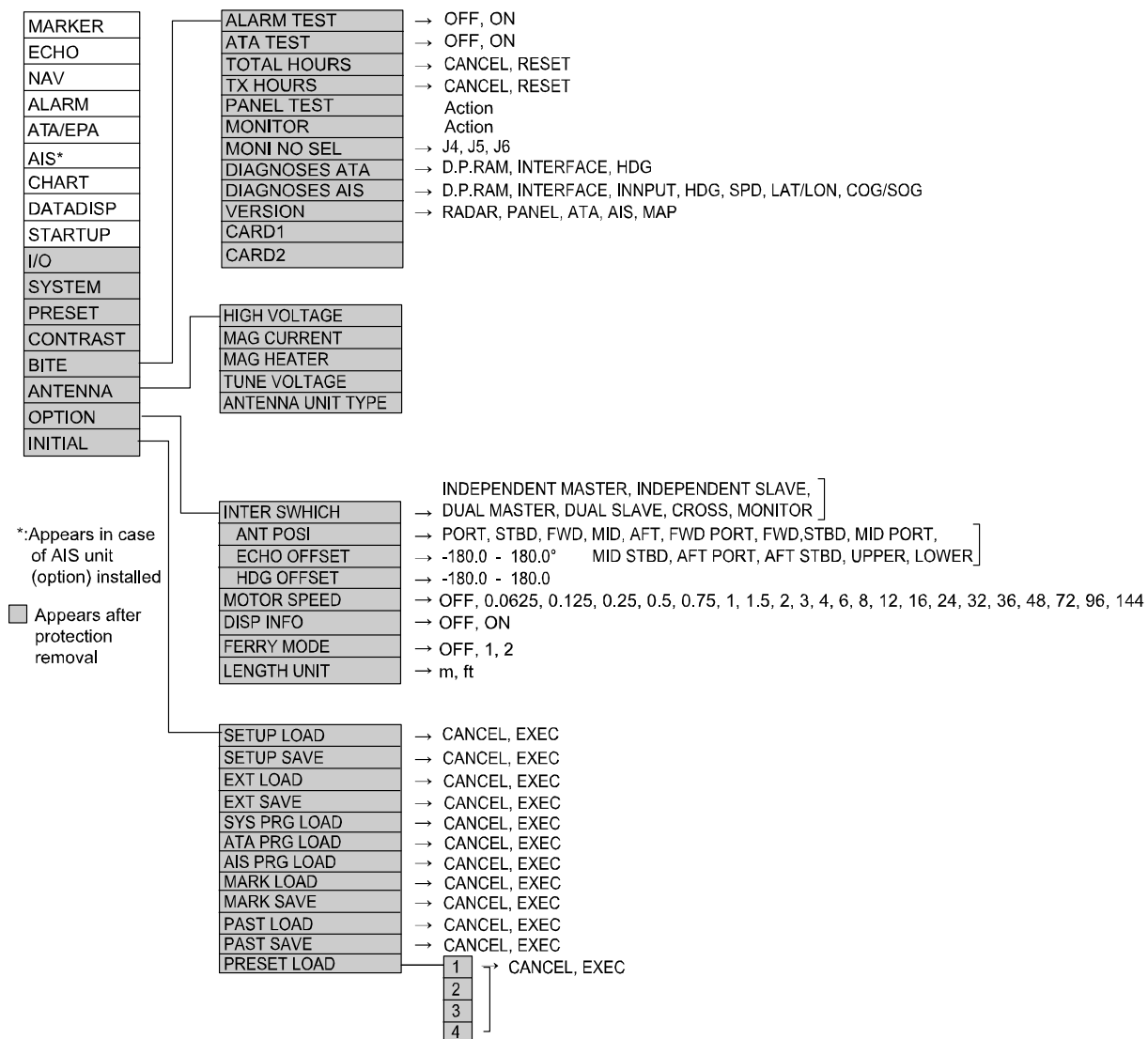
Not available.

4.19 Menu configuration









Chapter 5 Specification and configurations

5.1 Antenna

Model name	MDC-2240 MDC-2540		MDC-2260 MDC-2560		MDC-2210 MDC-2510		MDC-2220 MDC-2520	
Antenna type	RB716A		RB717A		RB718A		RB719A	
Antenna length	3feet	4feet	4feet	6feet	4feet	6feet	6feet	9feet
Horizontal beam width	2.5°	1.8°	1.8°	1.2°	1.8°	1.2°	1.2°	0.8°
Vertical beam width	22°	22°	22°	22°	22°	22°	22°	25°
Antenna rotation rate	24 rpm or 48 rpm							
Transmitting Power	4 kW		6 kW		12 kW		25 kW	

5.2 Display unit

Model name	MDC-2240/2260/2210/2220		MDC-2540/2560/2510/2520
Display type	MRD-101		MRD-102
Operation Panel	-		MRO-102
Display	12.1 inch color LCD		15 inch color LCD
Resolution	1024 x 768 pixels		
Effective diameter	184 mm		228 mm
Echo color	Green/Yellow/Multi/White		
Off centering	Max to 66%		
Echo area	2 types (Full screen, In effective diameter)		
Range accuracy	8 m or 1 % of selected range scale		
Range	0.125, 0.25, 0.5, 0.75, 1, 3, 6, 12, 24, 48, 96 NM Up to 48 NM for transmit output 4kW, Up to 72 NM for transmit output 6kW and 12 kW, Up to 96 NM for transmit output 25kW		
Display mode	Head up, North up*, and Course up*		
Other functions	Day/Night mode, VRM 2 marks (movable center), EBL 2 lines (movable original point), Parallel index line, Alarm, Trail (Track)** , Past course(Own track), Interference rejection, Mark, Route, Zoom, Dual station, Monitor output, External buzzer, etc.		
NMEA Input/output	2 CH (Input/Output) + 1CH(Input only)		
Power supply	10.8 to 41.6 V (21.6 V to 41.6 V for transmitting output 25 kW)		
Power Consumption (at 24VDC)	MDC-2240: 80 W or less		MDC-2540: 100 W or less
	MDC-2260: 110 W or less		MDC-2560: 130 W or less
	MDC-2210: 130 W or less		MDC-2510: 150 W or less
	MDC-2220: 170 W or less		MDC-2520: 200 W or less
AIS interface	200 targets (option)		
ATA	50 targets (Manual ACQ + Auto ACQ)		
Temperature	-15°C to +55°C		

* Requires heading data input.

** Requires heading bearing data, speed data input for True trail.

5.3 Configuration items

Standard configuration

(For MDC-2200)

Antenna / Scanner	Antenna	1
	Scanner unit	1
Display unit		1
Connecting cable (15 m as standard, 20m, 30m are to be prepared)		1
DC power cable		1
6-pin water resistant connector		2
Spare parts		1
Installation material		1
Operation manual		1
Installation manual		1
Quick reference		1

(For MDC-2500)

Antenna / Scanner	Antenna	1
	Scanner unit	1
Display unit		1
Operation Panel		1
Connecting cable (15 m as standard, 20m, 30m are available)		1
DC power cable		1
6-pin water resistant connector		2
Spare parts		1
Installation material		1
Operation manual		1
Installation manual		1
Quick reference		1

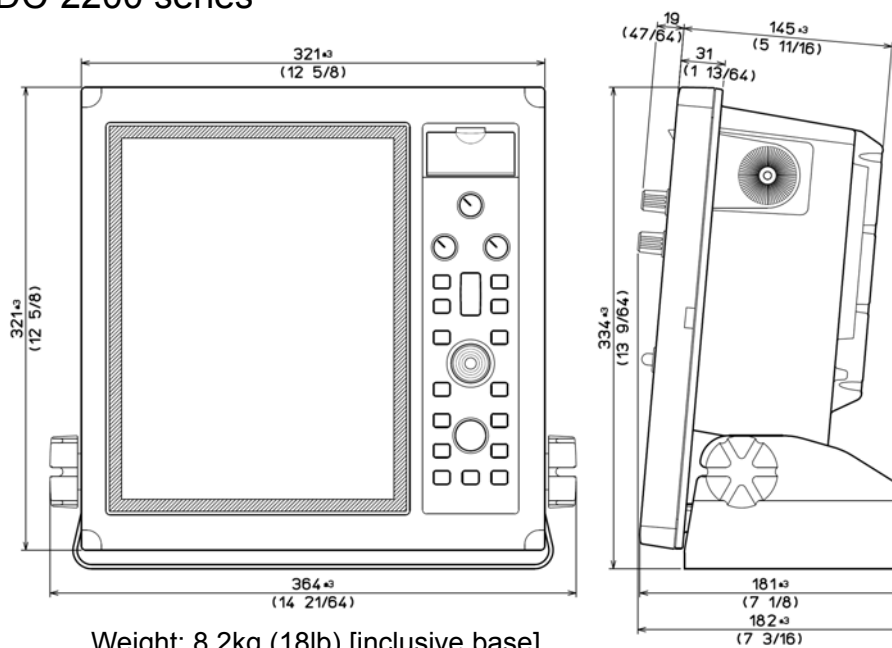
Options

Gyro/Log interface
AIS interface
Power rectifier
AC power cable
Connecting cables (20m, 30m)
Connecting cable for external monitor and buzzer

5.4 External view and dimensions

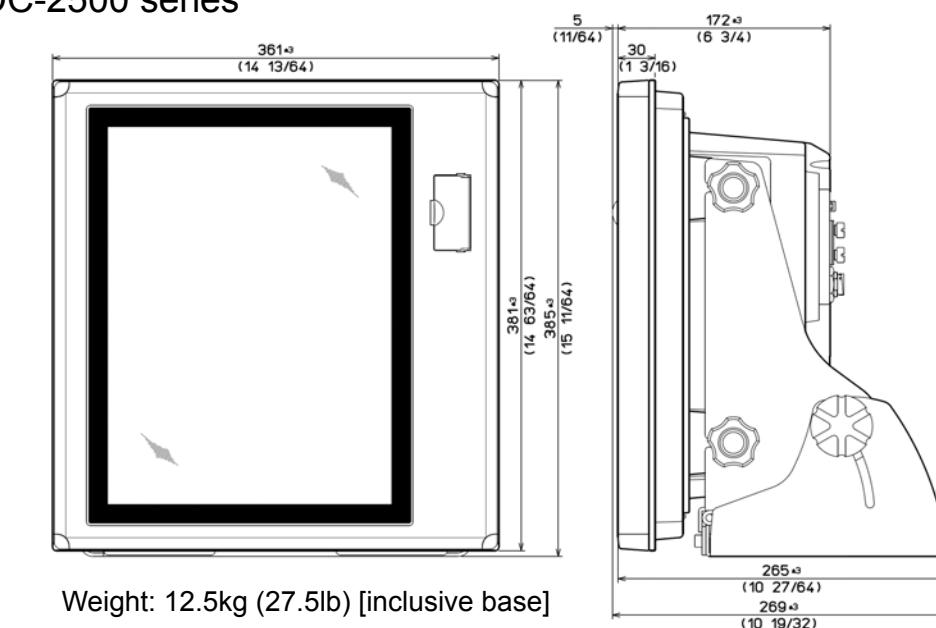
MDC-2200 series

Unit: mm (inch)

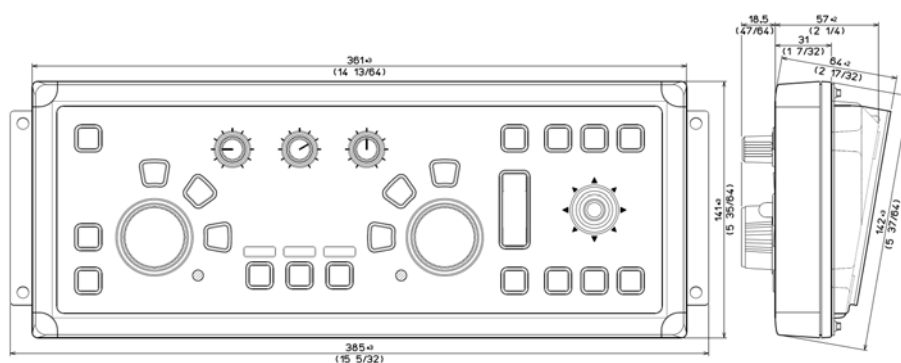


Weight: 8.2kg (18lb) [inclusive base]

MDC-2500 series



Weight: 12.5kg (27.5lb) [inclusive base]



Weight: 2kg (4.5lb) [inclusive base and connecting cable]

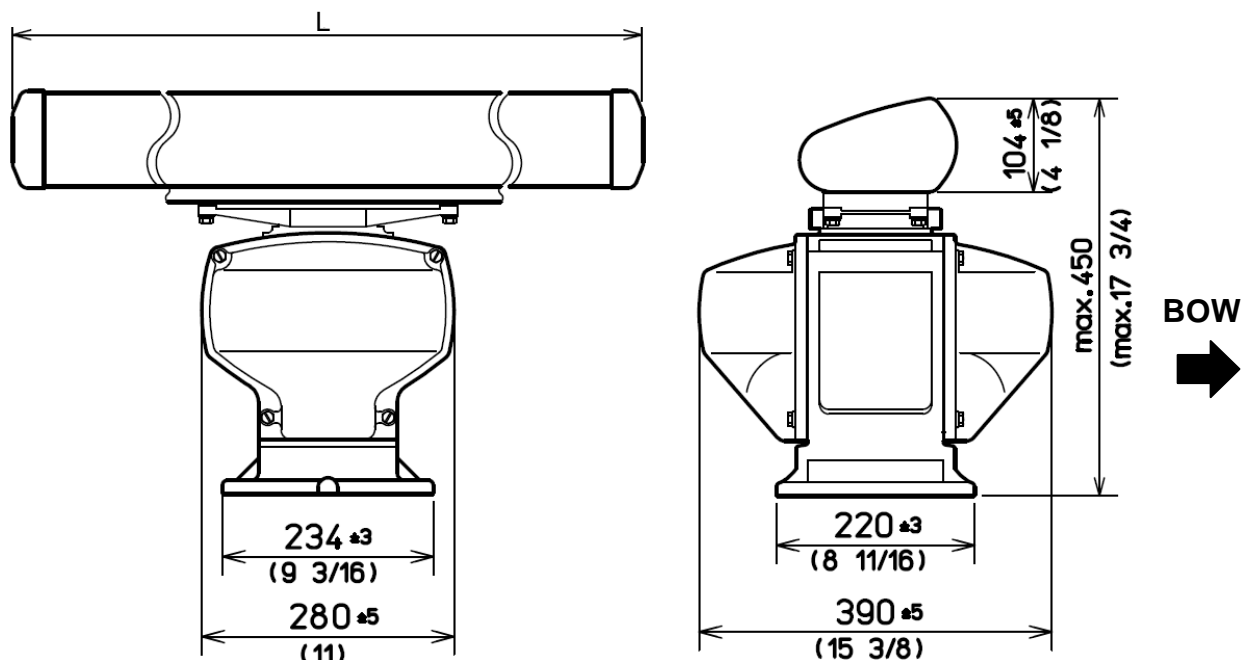
RB716A/RB717A/RB718A

Unit: mm (inch)

L = 3ft (RW701A-03) : 1034 (40 11/16) ± 5
 4ft (RW701A-04) : 1346 (53) ± 10
 6ft (RW701A-06) : 1970 (77 9/16) ± 10

RB716A
 Weight =
 3ft : 21.5kg (47lb)
 4ft : 22.5kg (50lb)

RB717A/RB718A
 Weight =
 4ft : 23kg (51lb)
 6ft : 25kg (56lb)

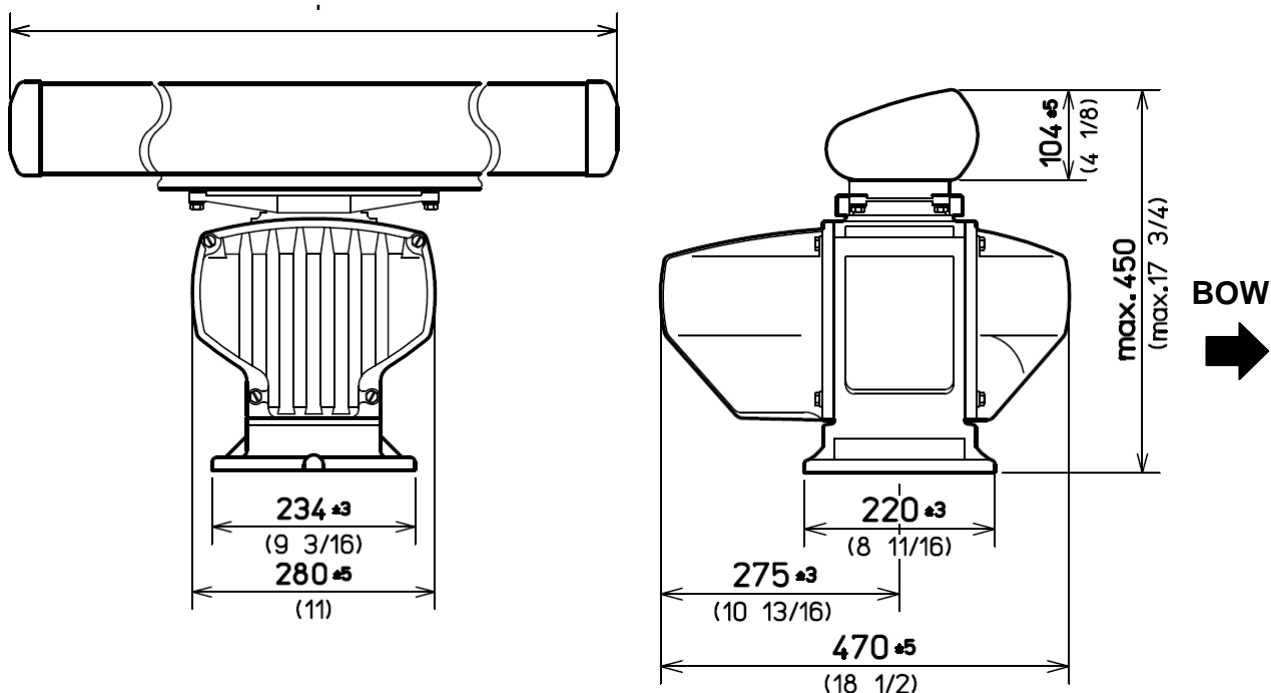


RB719 A

Unit: mm (inch)

L = 6ft (RW701A-06) : 1970 (77 9/16) ± 10
 9ft (RW701B-09) : 2740 (107 7/8) ± 10

Weight = 6ft : 29kg (64lb) ± 2 kg
 9ft : 33kg (73lb) ± 2 kg



Chapter 6 Principle of radar system

6.1 What is radar system?

The radar is a navigation device that transmits a very high frequency radio wave referred to as microwave from the antenna. The radar then receives the radio wave reflected by target(s) (e.g. other ship, buoy, island, etc.) via the same antenna and converts the received radio wave to electronic signals and sends these signals to the display unit. The radar makes it possible to find objects (targets), such as other ships, rocks or coastline, not seen by eyesight at night or in fog and allows ships to avoid these potential hazards.

As the antenna transmits while rotating, it is possible to see the current surrounding situation around your vessel at a glance.

The microwave radiated from the radar is referred to as pulse wave and the transmitting and receiving of these waves is alternated. Up to thousands of pulse waves are transmitted and received during one 360-degree rotation

The typical radar antenna is parabolic type or slotted array type and its performance is essential for good radar performance. Some of factors affecting the quality of the target returns are antenna beam width and side lobe level. The narrow beam width provides high resolution for angular orientation to distinguish objects and the low side lobe level reduces false image effect.

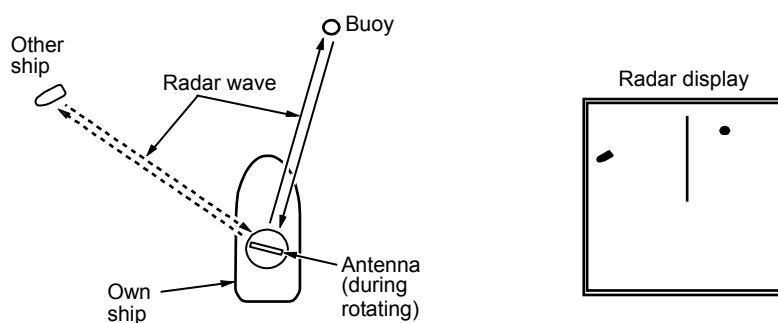


Figure 6-1 What is Radar?

Side lobe

The main lobe means the strongest radiated beam sent from the specific antenna, and the other weaker beams, are referred to as a side lobes. A side lobe level is a difference between the largest side lobe level and main lobe level.

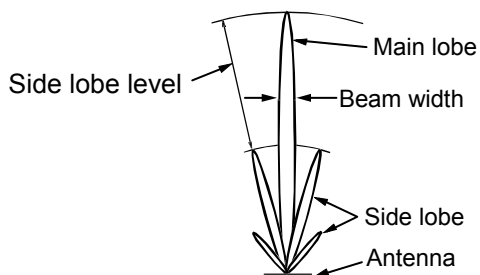


Figure 6-2 Antenna pattern

Beam width

Antenna beam width is defined as the angle where the radiation power density is within a half of maximum power density (-3 dB) in main lobe (also, referred to as "half value width").

6.2 Characteristics of radar radio wave

The radar radio wave propagates slightly along the ground (primarily line of sight). This characteristics varies depend on density of atmosphere but is generally calculated according to the formula as shown below, considering that the distance with radar sight D is about 6 % longer than the distance with optical sight.

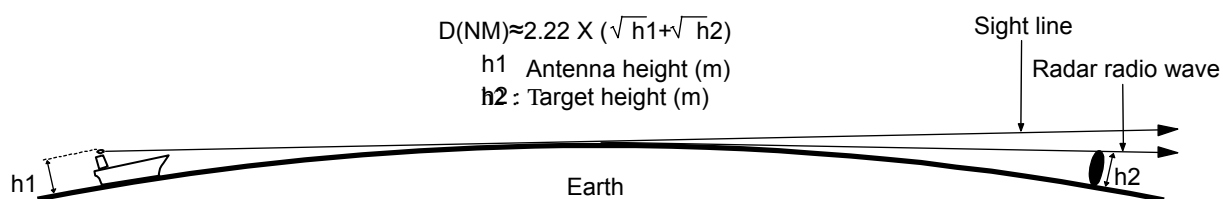


Figure 6-3 Characteristics of radar radio wave

Target hardness reflected

The strength of the reflected wave from a target varies depending on not only the distance from the target, its height or size, but also its material and features. A target with a low degree of reflection or low incident angle, such as FRP and wooden is not reflected well. Therefore, care shall be taken that an FRP ship, a wooden vessel or an object such as sand, a sandbar and muddy cay are poor radar targets.

Since the distance from the coastline, etc. to your ship on a radar image tends to be seen as longer than that from the actual coastline, more caution should be used navigating around such objects..

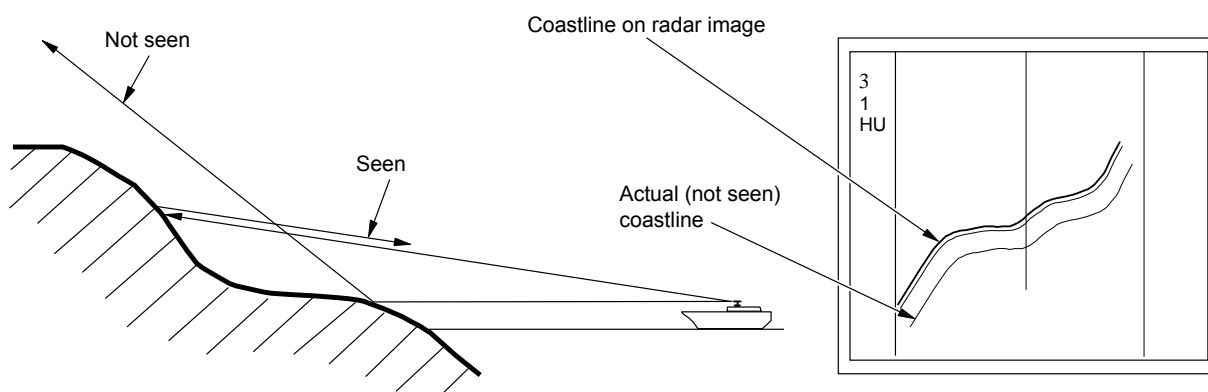


Figure 6-4 Example of targets hard to be reflected

Radar shadow

Since radar radio wave is line of sight in nature your stack mast close to the antenna or, a large ship or mountain can create blind spots for which the radar cannot penetrate.. In such cases, they may completely or partially hide targets and cast a long shadow.

Since the shadow your stack or mast is known at the time of installation, proper selection of the antenna location is necessary to reduce the shadow effect. Since targets less likely to be seen in this shadow area than in open sea, extra attention should be used in shadowed areas.

False image

An image that does not actually exist (false image) at sea may appear on the display.

The phenomena that causes false echoes are categorized and be described as follows:

- False image

The image of large physical object in a close proximity may appear in two different orientations. One is a real image and the other is a false image caused by wave re-reflected on the stack or the mast, etc. On the display, one image appears with a right distance and bearing, and another one appears in the direction of a stack, a mast, etc. These images may also be generate by being re-reflected from bridges and quays too.

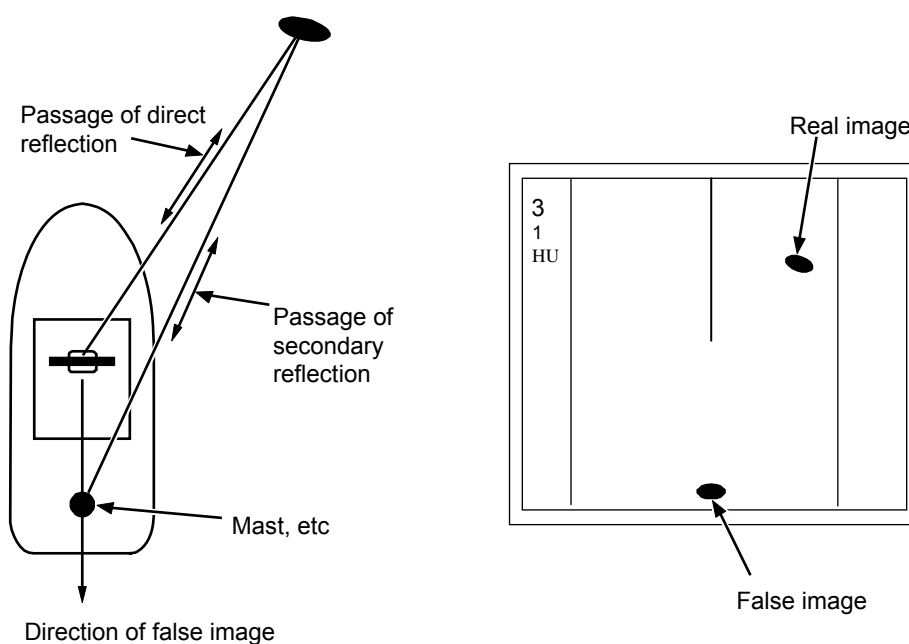


Figure6-5 False image by virtual image

- Duplicate target images

When there is a big reflective surface nearby and perpendicular at a close distance, (i.e. when your ship is passed by a big ship, etc.), radio wave bounce between your ship and the other ship. Therefore, 2 to 4 images may appear at equal range in the direction of this target. The false image generated by this multi-path reflection is referred to as “double targets”. In this case, the closest target is the real one.

You will notice as the distance and bearing between own ship and the reflective target changes the duplicate targets will disappear. Therefore, this false image can be easily distinguished.

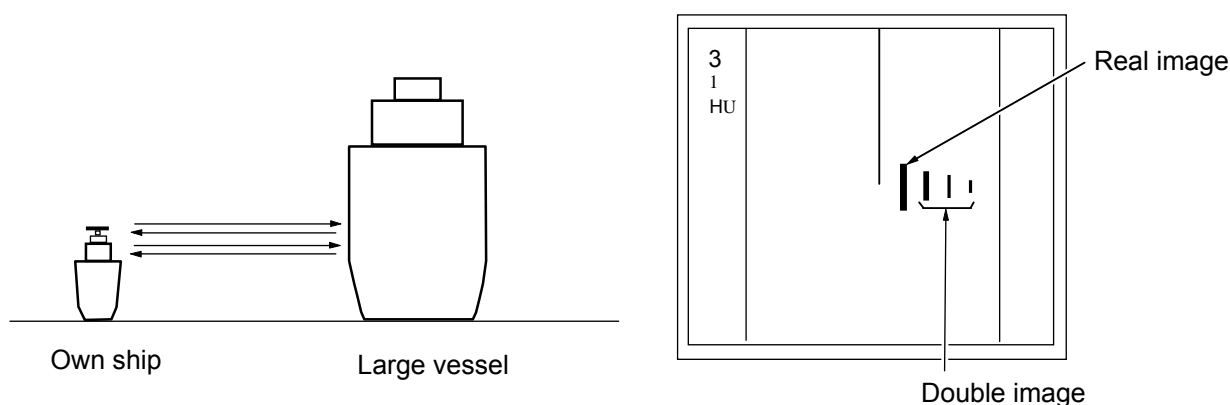



Figure 6-6 False image caused by double image

The microwave beam radiated from the antenna has a side lobe in different direction than that of the main beam. Since this side lobe level is lower than that of main beam, the effect is negligible for targets at long range, but a close, strong reflecting target may cause false image appearing in a circular arc shape.

 CAUTION	Close to large targets such as land, a circular image may appear.
--	---

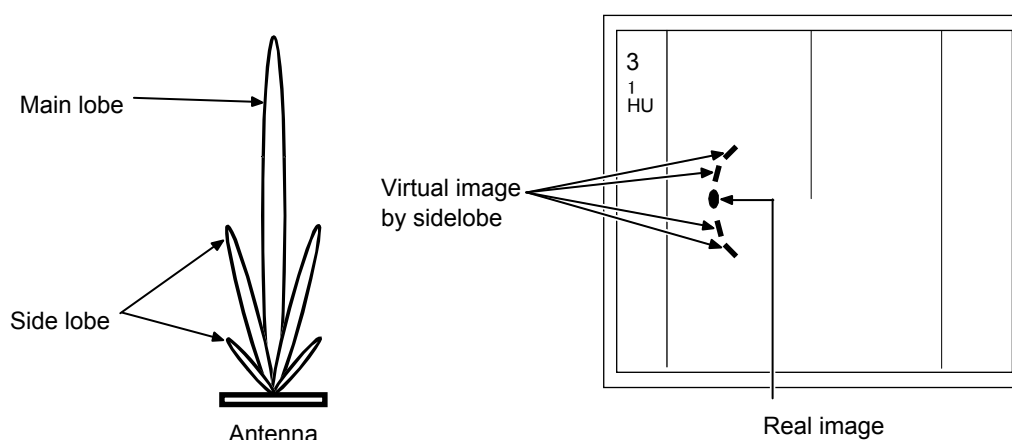


Figure 6-7 False image by sidelobe

- False image of a distant target caused by “skip” phenomenon

Depending on a weather conditions, Skip appear caused by the temperature inversion layer of air, etc. In this case, the unusual propagation of the radio wave may reach distant targets out of the radar range. A target at more than the maximum range may appear as an image, and may be displayed as a false image closer than an actual distance. This phenomenon is a result of the long range echo delay time exceeds the transmission period, and is displayed as the echo in the following rotation. If the range scale is changed and the target range changes, it can be judged as a false image.

6.3 Radar interference

When the radar with the same frequency band is used nearby, interference noise appears on a display. Although appearance of interference is not constant, the shape is almost always swirling or radial. This device features an interference rejection facility to reduce interference.

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